ELECTRICAL
TIMES

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AEI CABLE DIVISION

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Copper faced " Paxolin " is available in three standard grades—
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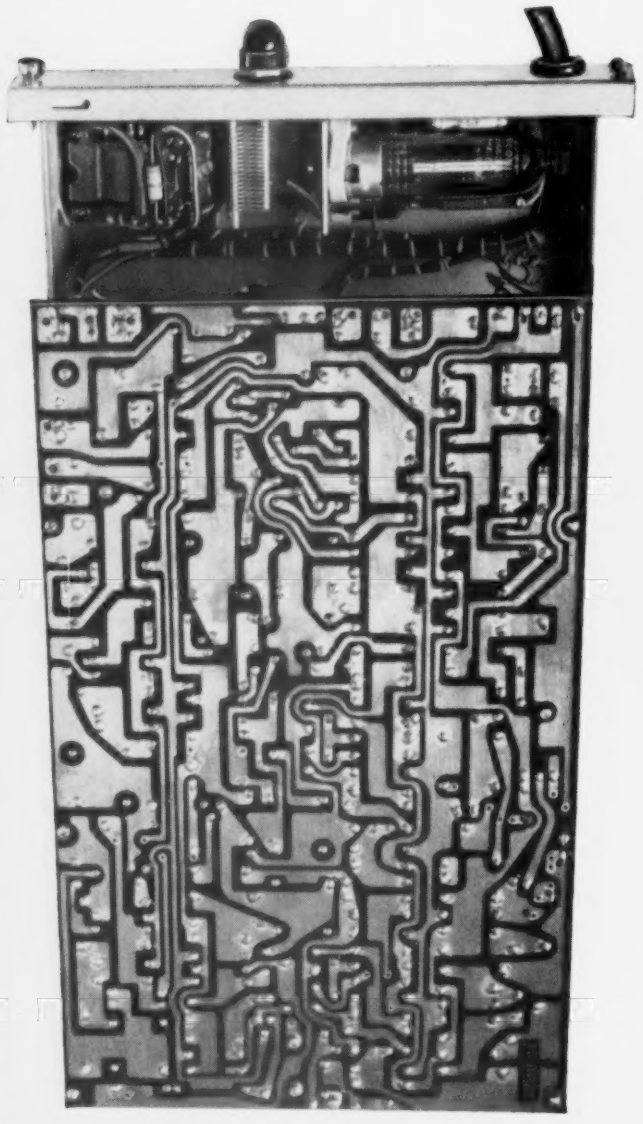
Use copper faced " Paxolin " for printed wiring in communications, control, electronic and other equipment . . . SAVES SPACE—REDUCES ASSEMBLY TIME—AIDS DIVISION OF COMPLEX CIRCUITS INTO CONVENIENT SUB-UNITS.
Other grades of copper faced "Paxolin" can be supplied if required and our engineers will be happy to discuss particular problems and offer advice.
Please write for our leaflet on copper faced " Paxolin ".
" Paxolin " is a registered trade mark.



Copper-faced "Paxolin" in a transistorised carrier unit of the MC10 V.H.F. Radio Telephone Terminal. Photograph by courtesy of A.E.I. Telecommunications Division.

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Main illustration. *A general view of the boiler under construction. This is an outside job, but the operating front is housed in the turbine building.*

Inset illustration. *This close-up of the top three banks of the evaporator, taken before the chamber walls were fitted, shows the type of evaporator surface.*

This O T boiler, generating 240,000 lb/hour of steam at 3,300 p.s.i. and 1,060°F (the highest steam conditions yet commercially used in Britain), with reheat to 840°F, forms part of a topping installation to supply the steelworks with additional process steam and electric power.

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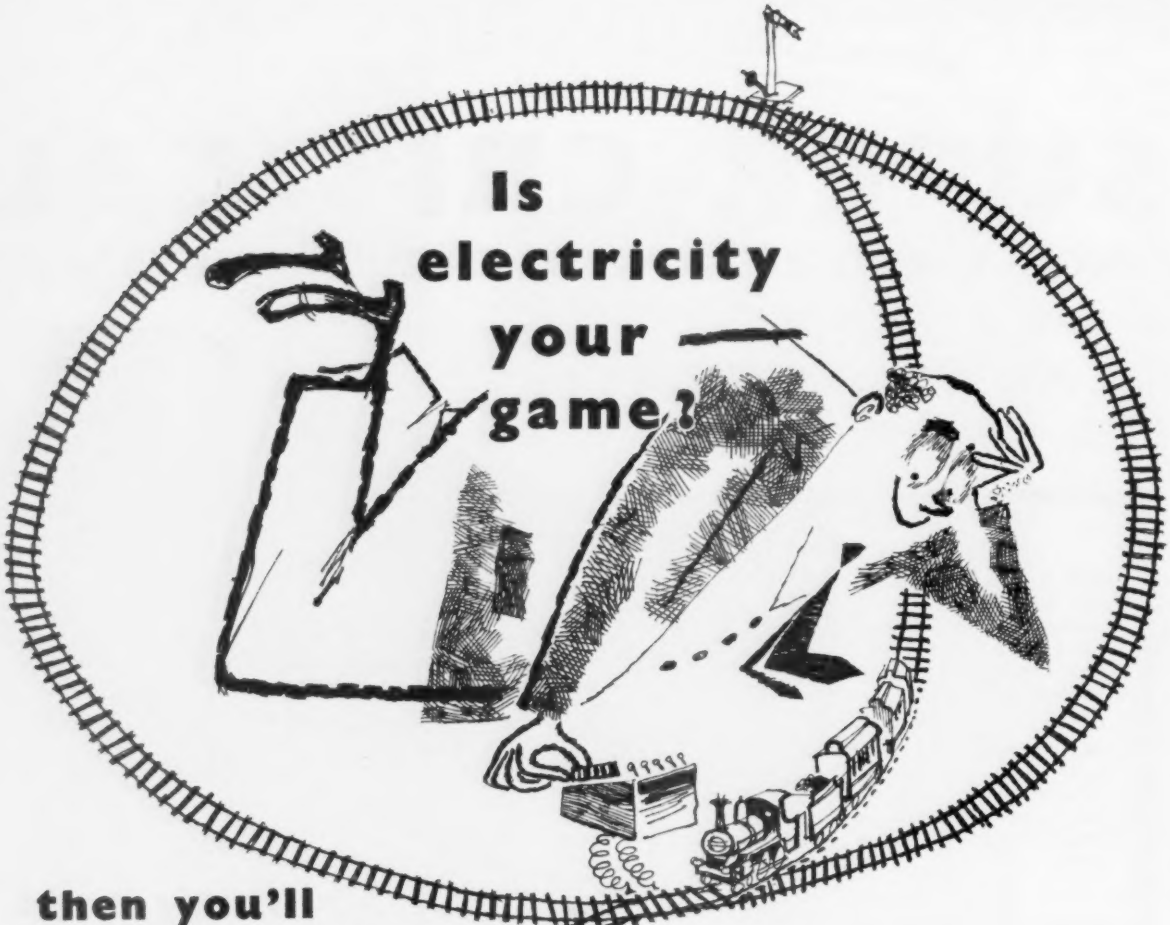

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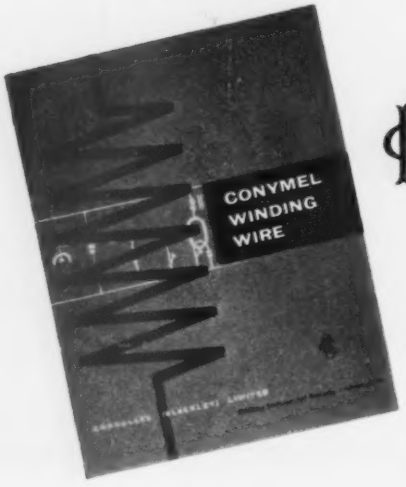

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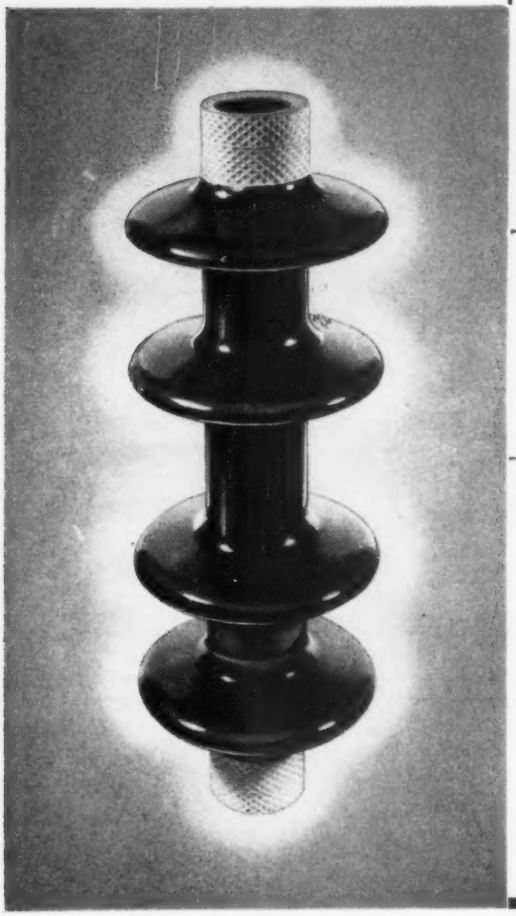

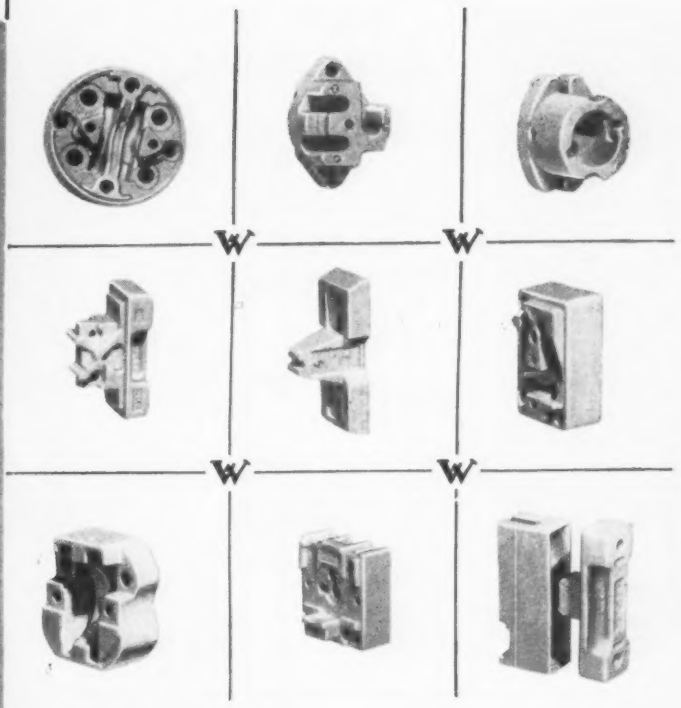

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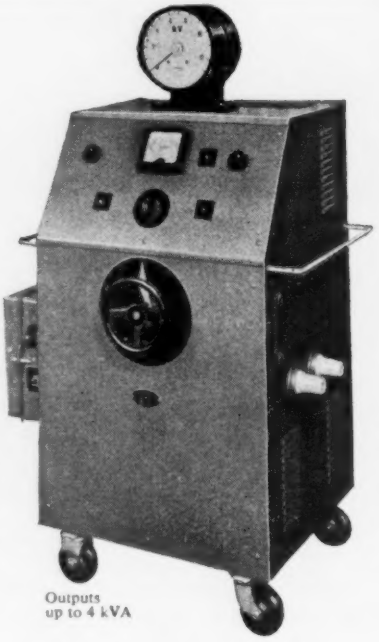

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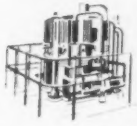

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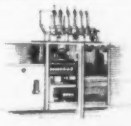

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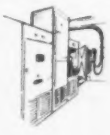

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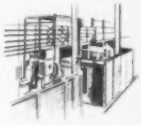

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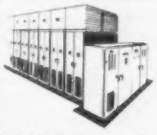

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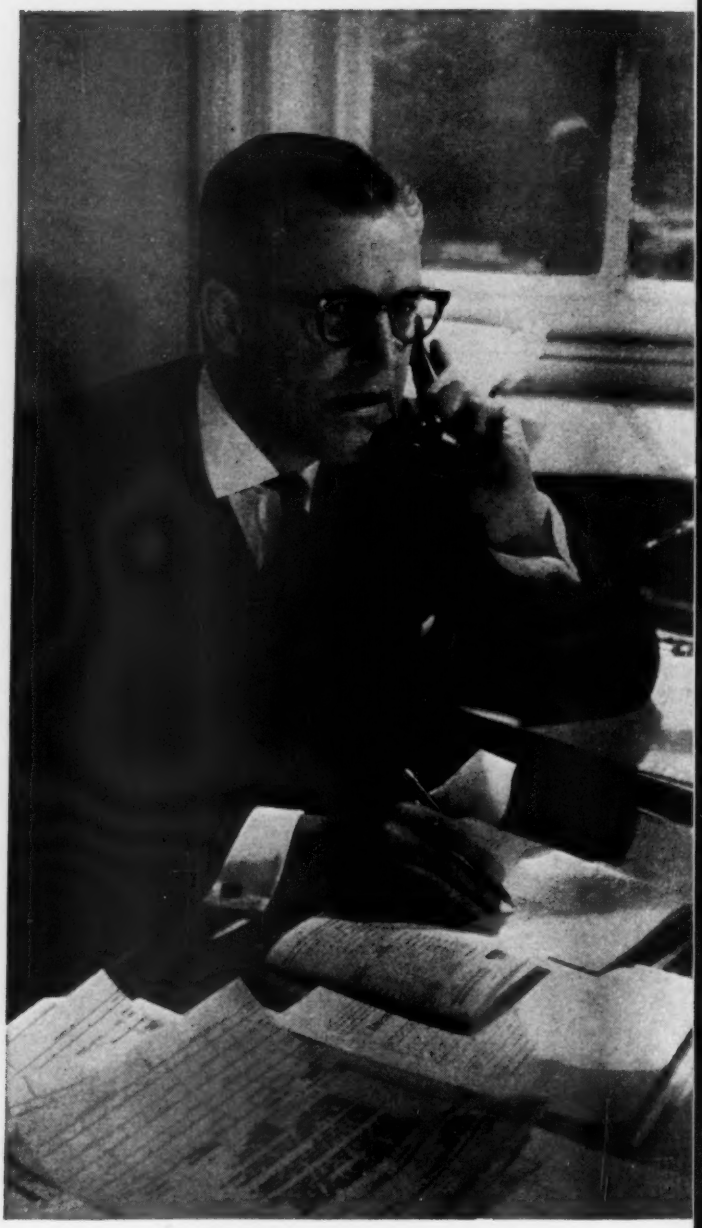

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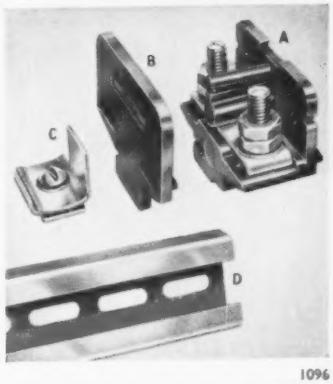

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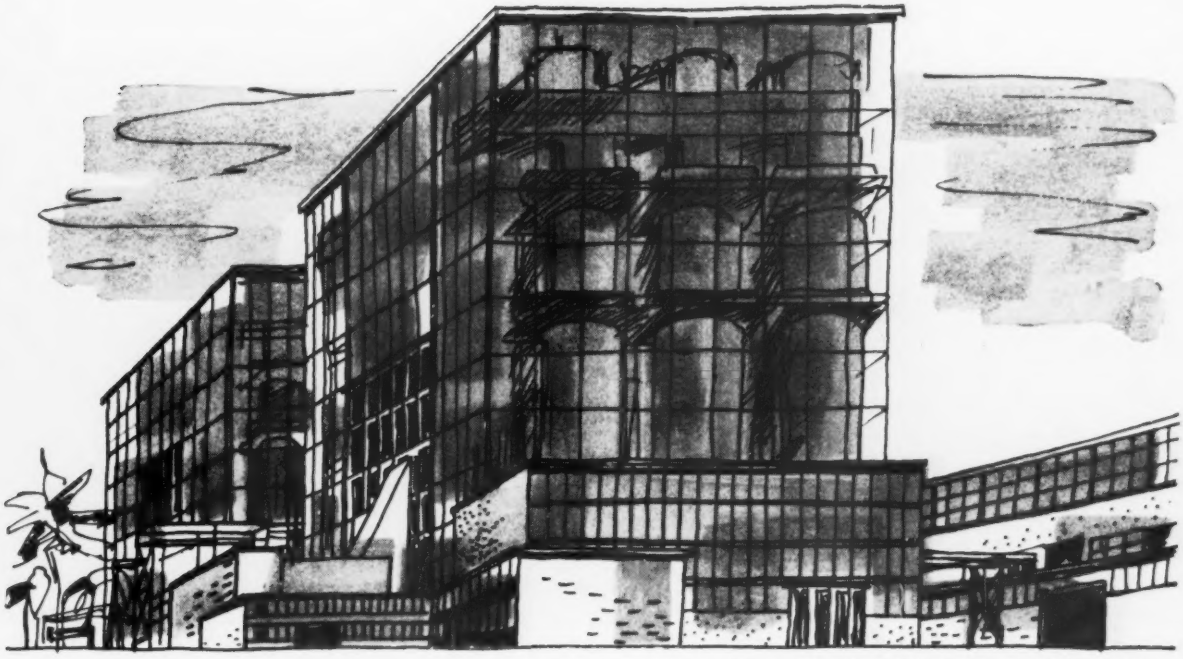

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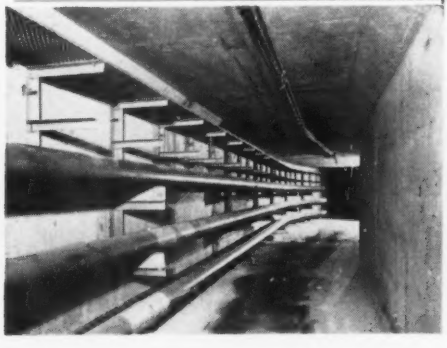

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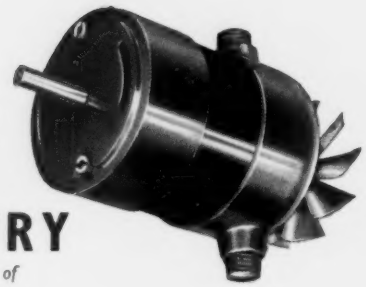

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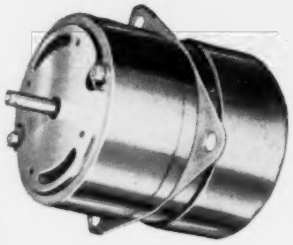

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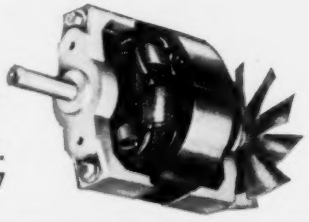

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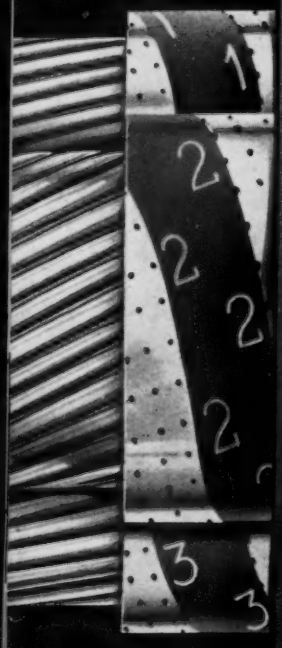

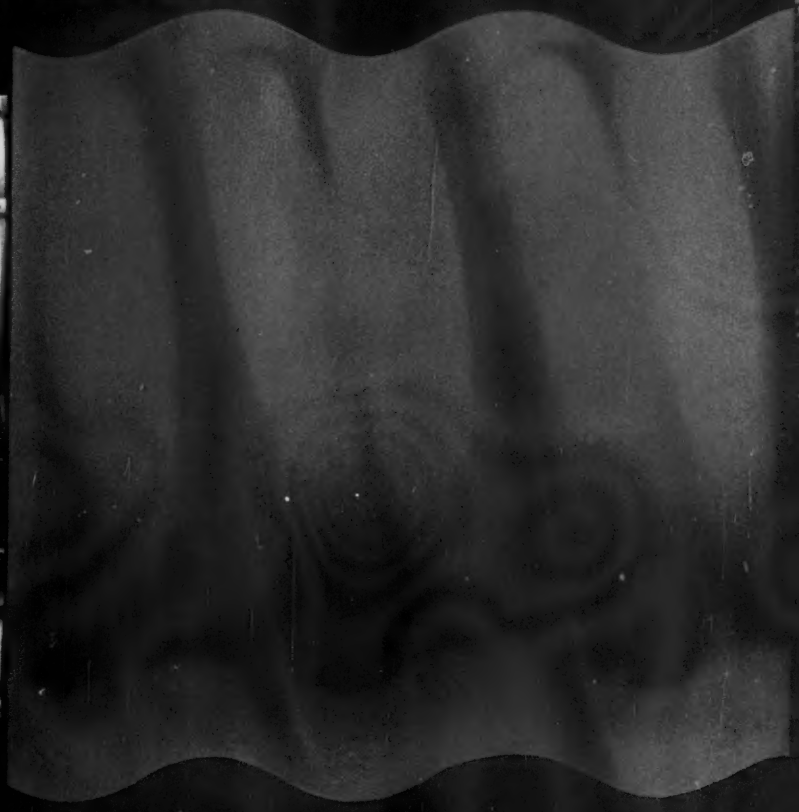

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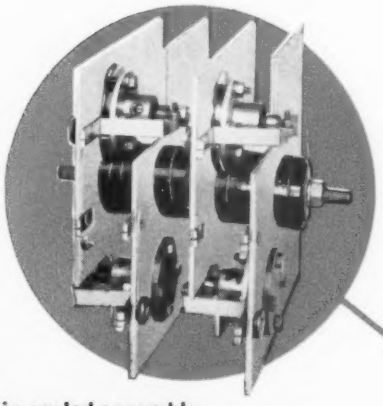
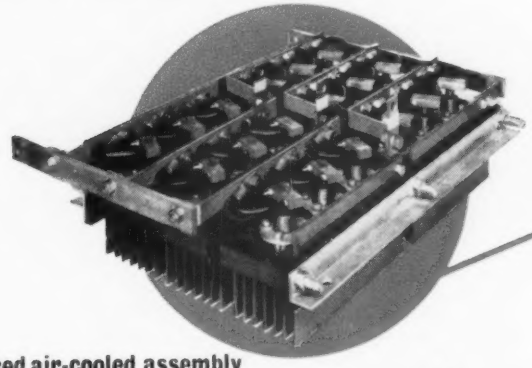
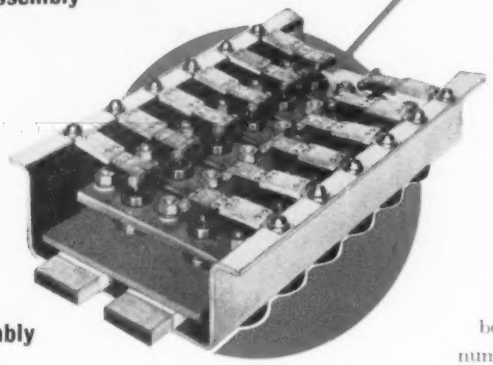


Natural air-cooled assembly



Forced air-cooled assembly



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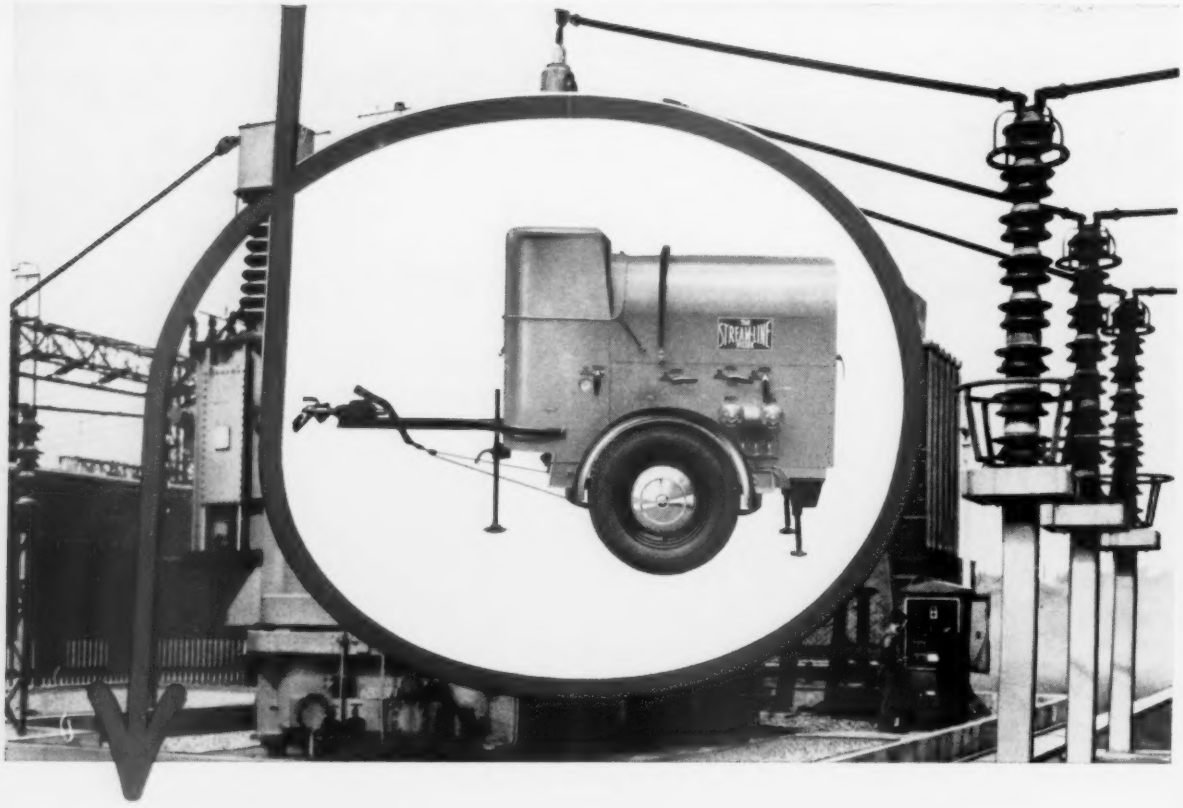
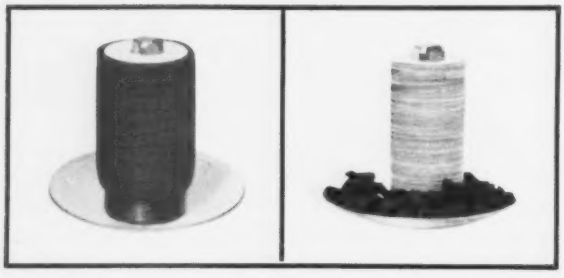


Loop in a Stream-Line filter



These illustrations show the Stream-Line filtering element built up of special paper discs under end pressure. Oil passes through the infinitesimal interstices between the discs leaving solid impurities at the paper edges. Instantaneous cleaning is carried out by a reverse flow of compressed air.

The security of oil-immersed circuit-breakers and transformers depends on the condition of the insulating oil, for if it contains impurities and moisture a serious loss of insulating protection will occur. The Stream-Line filter, embodying filtering elements, heating chamber and vacuum receiver, is the most perfect practical safeguard against this happening. A *single* passage of oil through a Stream-Line filter ensures the elimination of *all* solid impurities including the finest colloidal carbon. In addition, dehydration and de-aeration ensure the removal of all free and dissolved water and gases—*and the filtered oil will have a dielectric strength far above that specified for new oil.*

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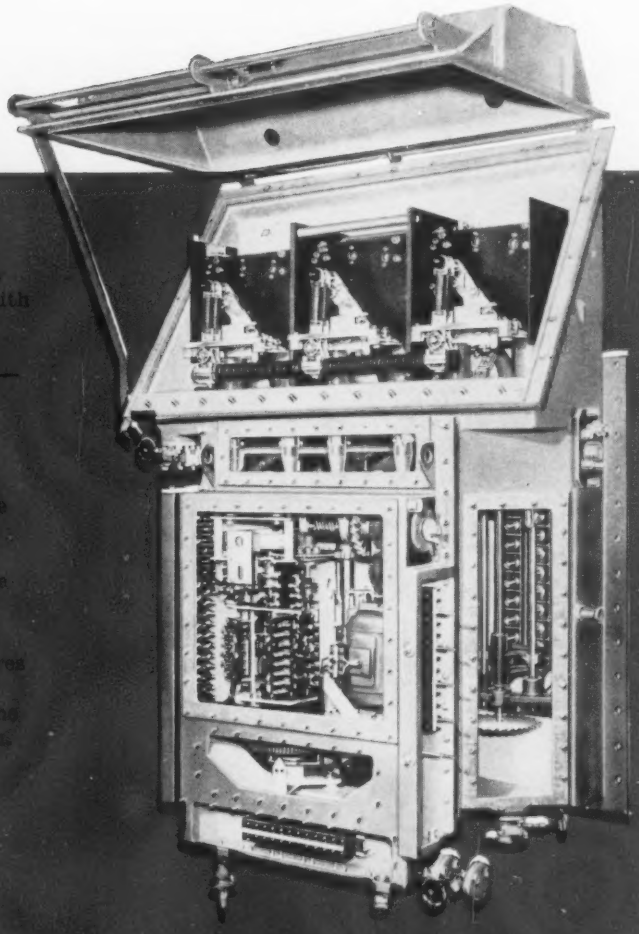

200,000 is a pretty impressive figure by any standard, but when it is linked with the number of operations carried out on the Ferranti D.C.3 Tap Changer using the same set of arcing contacts—and this is a proven test, not an estimate of performance—it is an achievement which will readily be appreciated by supply engineers.

The tap changer performed an average of 330 operations per hour at a rating equal to full load on a 10 MVA 33 kV System Transformer, running over the whole range step by step in both directions.

There are many other excellent features in D.C.3 that are worth knowing, and our experts will be delighted to have the opportunity of explaining them to you. Please write for a copy of the D.C.3 Brochure which presents the equipment in the fullest detail.

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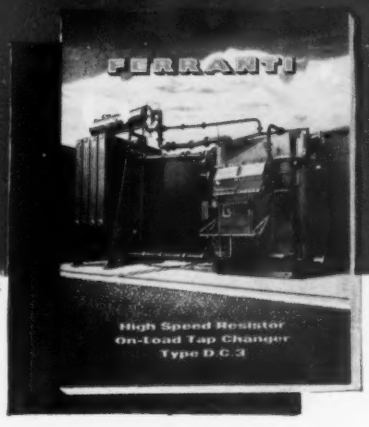
High Speed Resistor On-Load Tap Changer Type D.C.3



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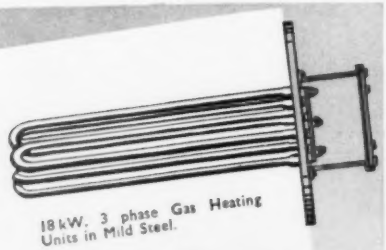
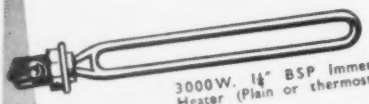


18 kW. 3 phase Gas Heating Units in Mild Steel.



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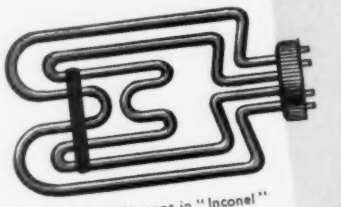
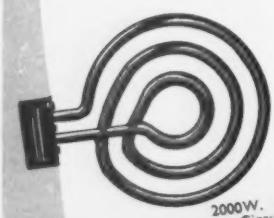


2500W. Grill Element in "Inconel"



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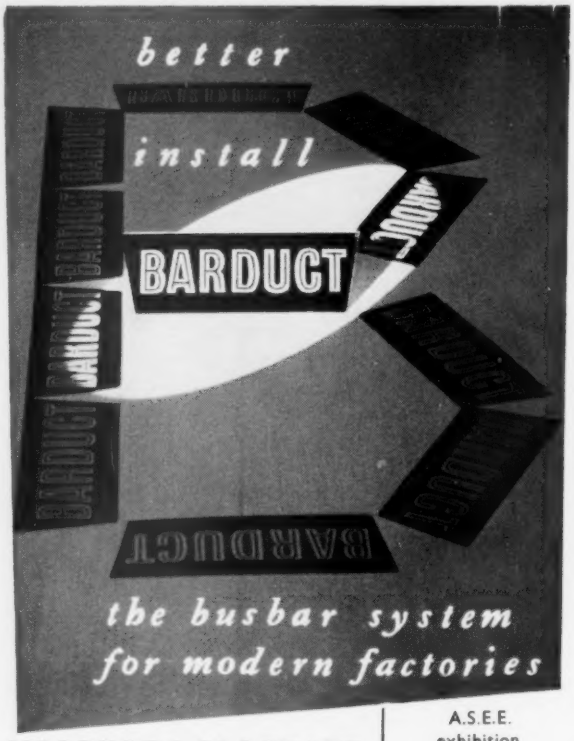

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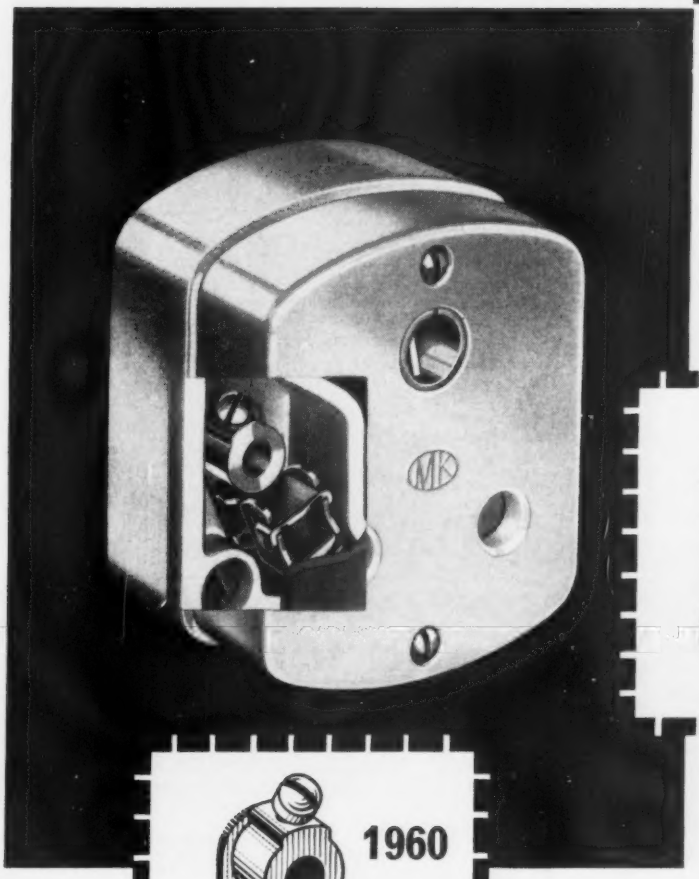

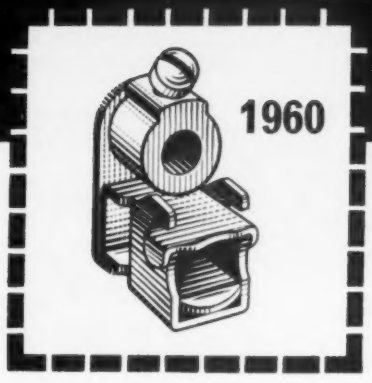

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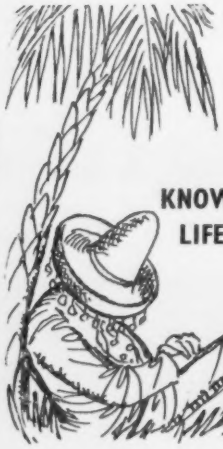

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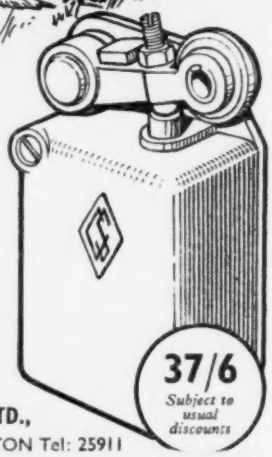

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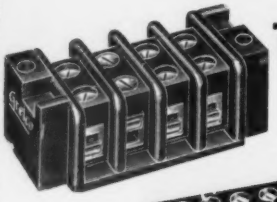

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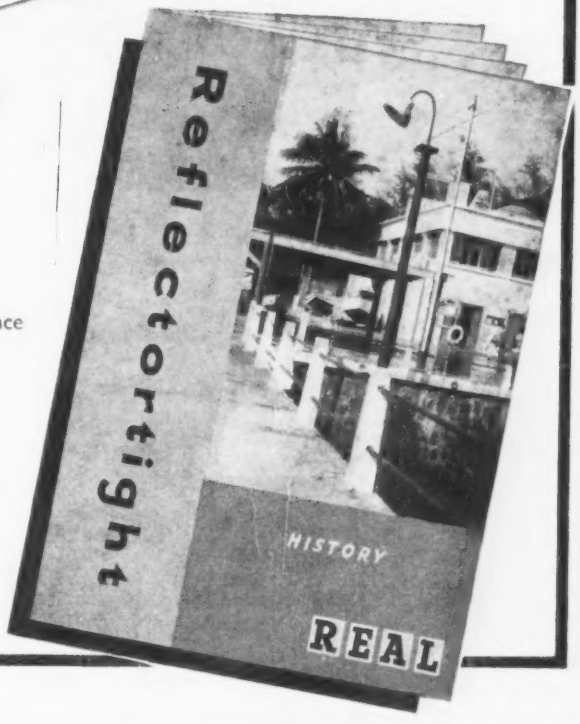

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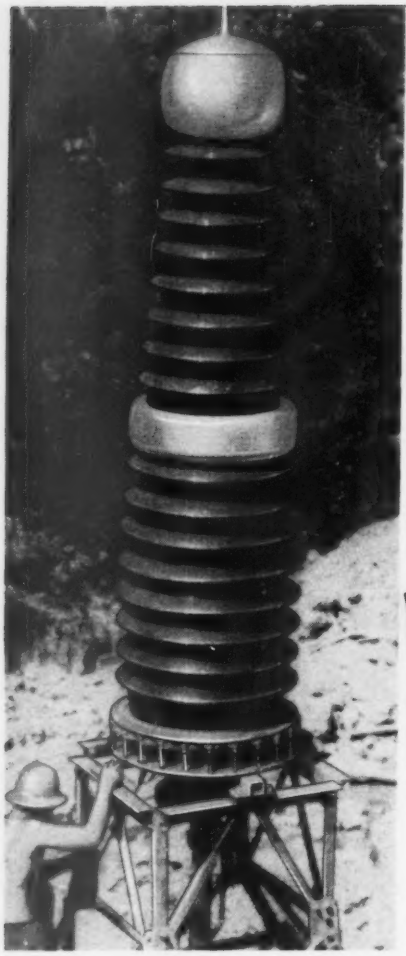

This photograph of one of the Sealing Ends is reproduced by courtesy of the Pirelli-General Cable Works Ltd.

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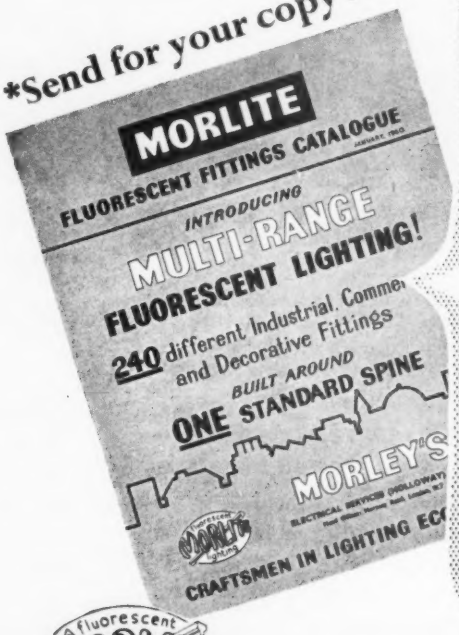

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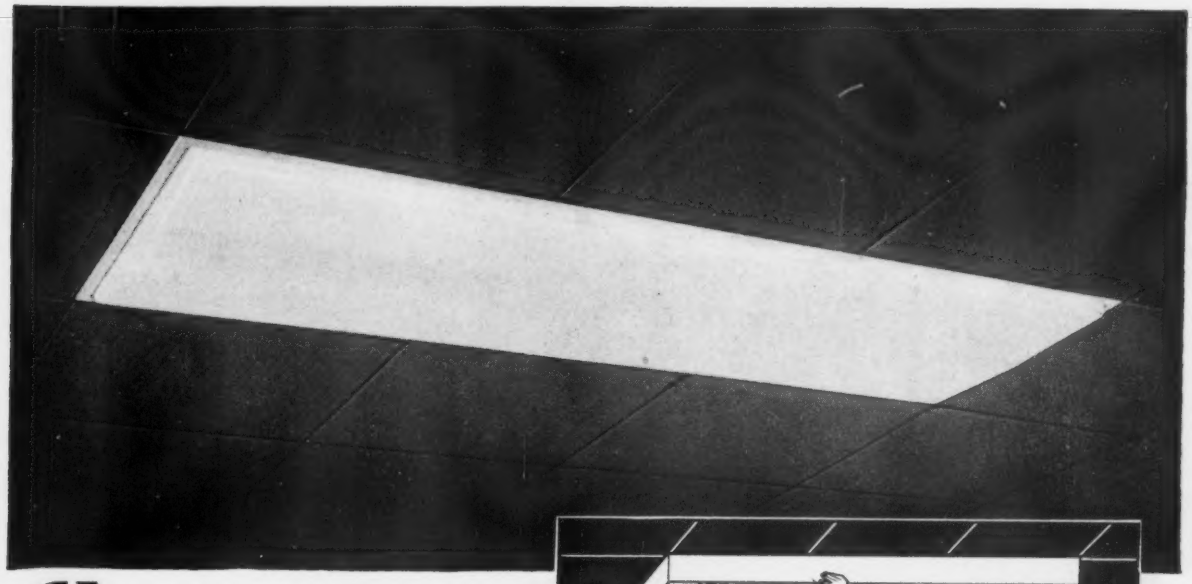

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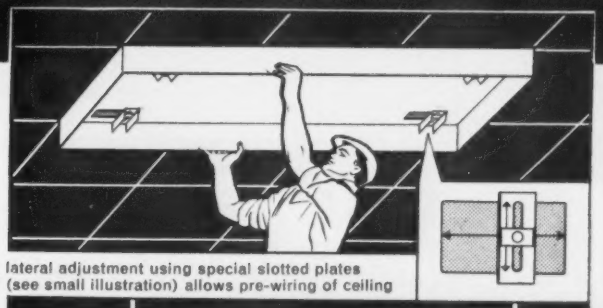
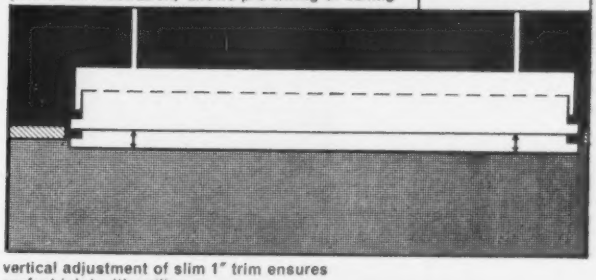
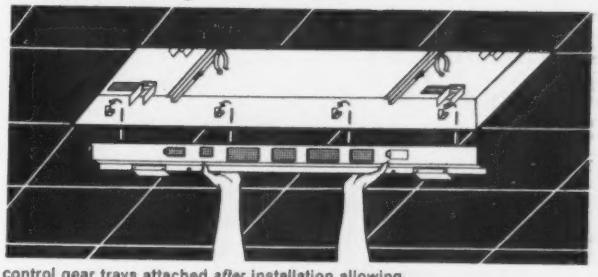


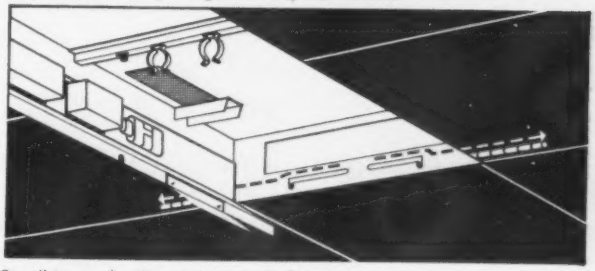
✳ lateral adjustment using special slotted plates (see small illustration) allows pre-wiring of ceiling



✳ vertical adjustment of slim 1" trim ensures perfect joint with ceiling

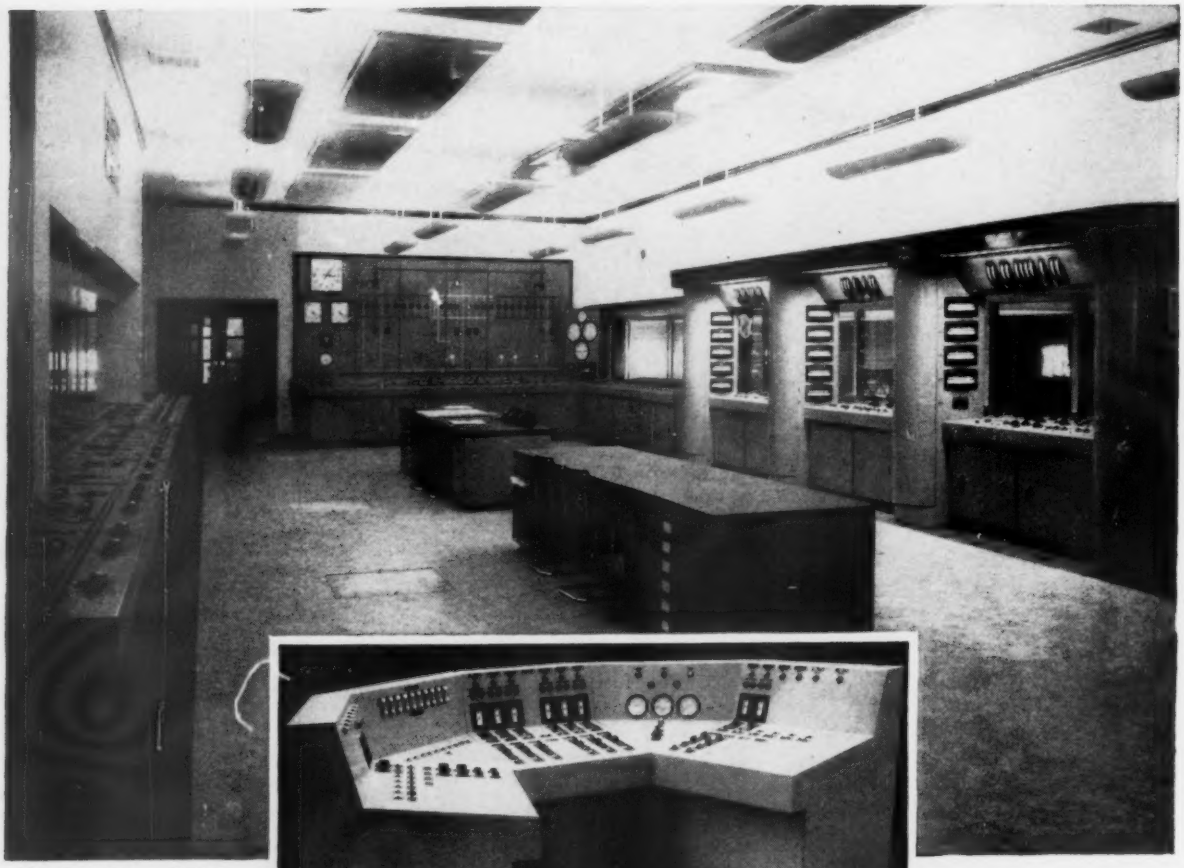


✳ control gear trays attached *after* installation allowing single-handed fitting—hinged for easy maintenance



✳ fits all types of ceiling and suspends from either true or false ceiling

DTV



Main Control Room, Ashford Common Pumping Station of the Metropolitan Water Board.

Power Station control desk, Central Electricity Board, Mauritius.

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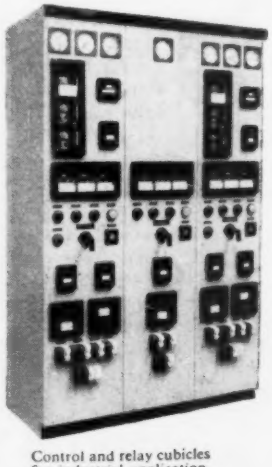

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Electrical Engineers' Exhibition at Earls Court open until Saturday. (585)

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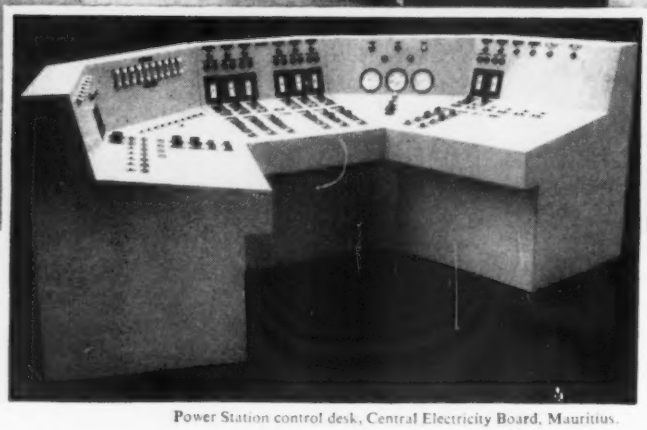
Main Control Room, Ashford Common Pumping Station of the Metropolitan Water Board.



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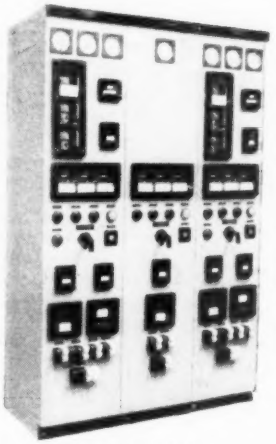

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Profits up on appliances, down on heavy plants shows survey of three months' company reports. Views of chairmen confident in facing prospect of more difficult trading. (561)

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PEOPLE—F. C. Winfield retires from Merz and McLellan partnership . . . J. A. Rodgers promoted to div. sales manager (accessories) BICC . . . C. J. Penny succeeds N. A. Mackay (retired) as sales manager, Transformers (Watford) . . . H. D. Weeks succeeding H. F. Castle (retiring) as S. Western EB district manager, Crewkerne, J. W. Roberts succeeds R. Robinson (retired) as district manager, Barnstaple . . . In GEC general products group reorganisation D. E. Kidner, appointed domestic equipment group sales manager; N. F. North, sales manager, installation equipment div.; F. E. Everard, manager, Pirelli-General; J. B. Smyth, manager, switchfuse, gear and accessories div.; J. L. Simpson, manager, conduit div.; W. A. Villiers, manager, lighting div.; A. L. Dandy, manager, industrial heating div.; and Ivor Williams, manager, market development . . . In Tricity cooker appointments D. W. Parks becomes sales promotion manager, G. A. Bilsland (ex-GEC) sales manager (London and South) and C. L. Holliday, London area manager. J. F. Skipsey also to be member, North Eastern E. B. . . . H. Brockelsby is new EPEA president. . . . G. M. Holland to succeed E. A. Cullen (retiring) as Eastern E. B. Essex sub area engineer and H. T. Ransley becomes Fens engineer. (572, 574)

NEWS SHEET

Growing use of a.c. supplies in ships marks major change in practice. Trend away from d.c. encouraged by oil-laden atmospheres and growing installed capacity, since d.c. unsuitable for above 250 V. (556, 557)

Nuclear Installation Act in force from 1 April. Regulations made to cover notification of any accidents releasing radioactive products. (585)

Petrol pump electrical installation requirements studied in survey of section 3 of IEE Wiring Regulations by chief technical officer, NICEIC, with accent on common installation faults. (562)

Electric motorised wheel dispenses with mechanical transmission gives high tractive and braking torques, better performance than conventional drives, intended for haulage vehicles. (583)

Fault warning by telephone extended to 33 kV stations in Fens sub-area Eastern EB. Datophonic system has repeat message and acknowledgement facilities; also low-battery warning. (569)

Oil-filled underground distribution transformer introduced as companion to dry type by Ferranti. Installed on N. West EB system. (566)

Nature and speculated origin of cosmic rays forms subject for Prof C. F. Powell's Kelvin lecture. Radiation thought to originate from condensation of stars and electromagnetic charges in nebulae. (576)

Electrical and engineering production in January 15% up on same month last year reports BoT. In 1959 increase averaged 13%. (585)

BUSINESS—A. H. Hunt (Capacitors) to build new factory at Eastbourne . . . Small profit increases by C. A. Parsons, A. Reyrolle and Sangamo Weston, but reduction by Superheater Co. . . . Hoover's home market turnover in first 11 weeks of 1960 slightly up and exports 35% up. (590)

OVERSEAS—Ontario H.E. Power Commission to build three more stations in N.E. Ontario . . . Nigerian Government adopts plan for Niger and Kaduna river development . . . Japanese collaboration in another Indian cable factory . . . ECA of Ontario preparing for licensing of electricians . . . Sir John Hacking reporting with J. S. Clinton on Rhodesia's electricity supply organisation . . . Saskatchewan's Boundary Dam power station to be opened on 14 May. (570, 571)

THE WORLD'S LARGEST NATURAL-CIRCULATION BOILER

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Babcock Radiant, reheat type, pulverized-fuel-fired, with an evaporation of 3,750,000 lb. hr. at 2400 lb. sq. in. 1055 F, for THORPE MARSH power station, Central Electricity Generating Board.

300 MW

Radiant, reheat units, pulverized-fuel-fired, for WEST THURROCK power station.

200 MW

Radiant units, pulverized-fuel-fired, for WEST THURROCK, WILLINGTON 'B' and KINCARDINE (with reheat); and HAZELWOOD (Australia).

100 MW TO 125

Radiant, reheat units, pulverized-fuel or 'Cyclone' fired, of capacities from 100 to 125 MW, for BLYTH 'A', RUGELEY, USKMOUTH 'B', PADIHAM 'B', FERRYBRIDGE 'B', ASNAES (Denmark), PONTBRULE FARCIENNES and MOL (Belgium), TIRRENA and CHIVASSO (Italy), KAWASAKI (Japan) and YALLOURN (Australia); also the six 100 MW units at CASTLE DONINGTON power station, which topped the efficiency table in 1959.

Central station boiler development in recent years has been remarkable for the steep rise in unit capacities, with parallel advances in steam conditions and the extensive use of reheat; achieving valuable gains in thermal efficiency. This development reflects intensive progress—in design, engineering and manufacture—by the BABCOCK organization, which has supplied, or is currently manufacturing, a considerable number of boilers of from 100 to 300 MW capacity, and which is now to supply a unit of 550 MW capacity—the first to provide this huge output from a single-furnace natural-circulation design.

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NEWS SHEET

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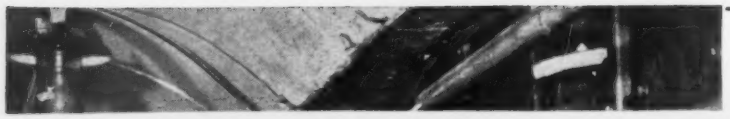

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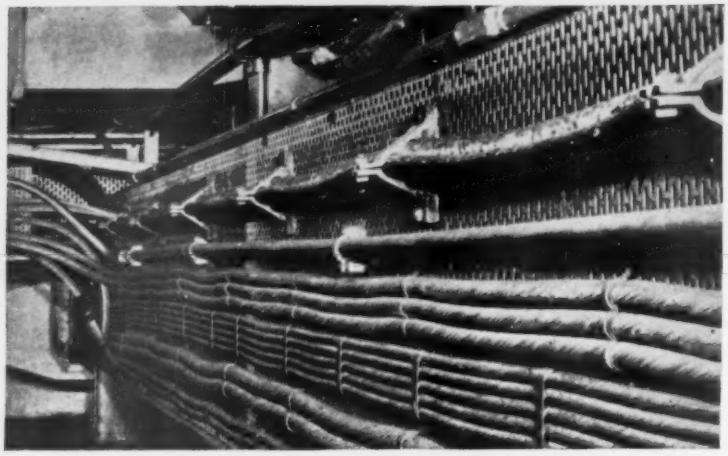

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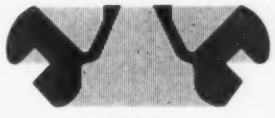

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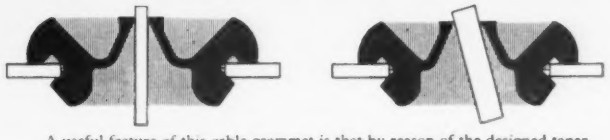

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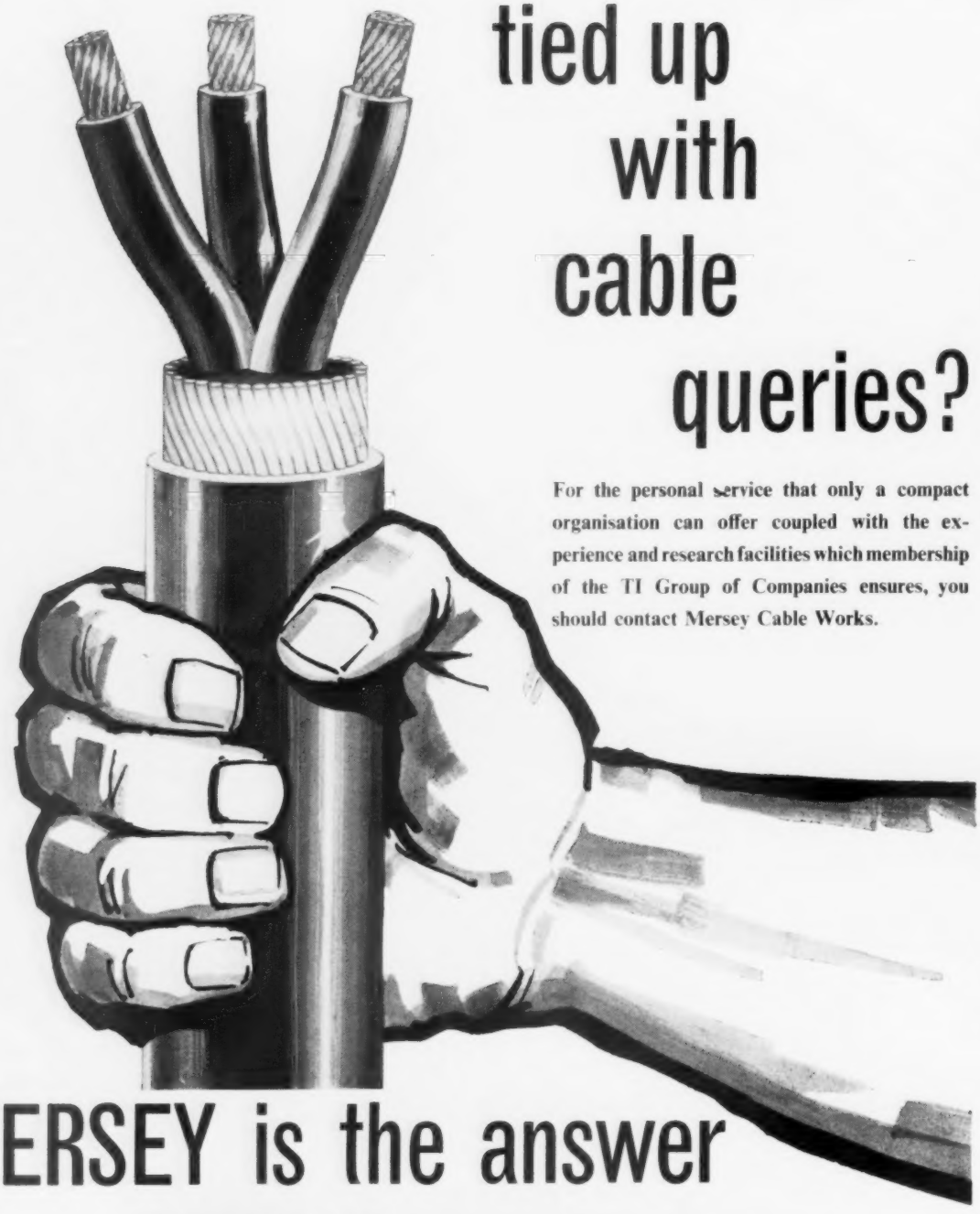

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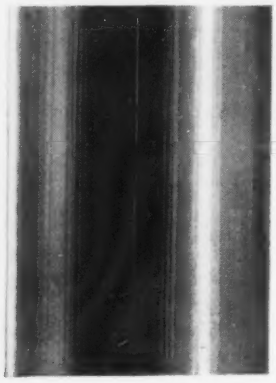

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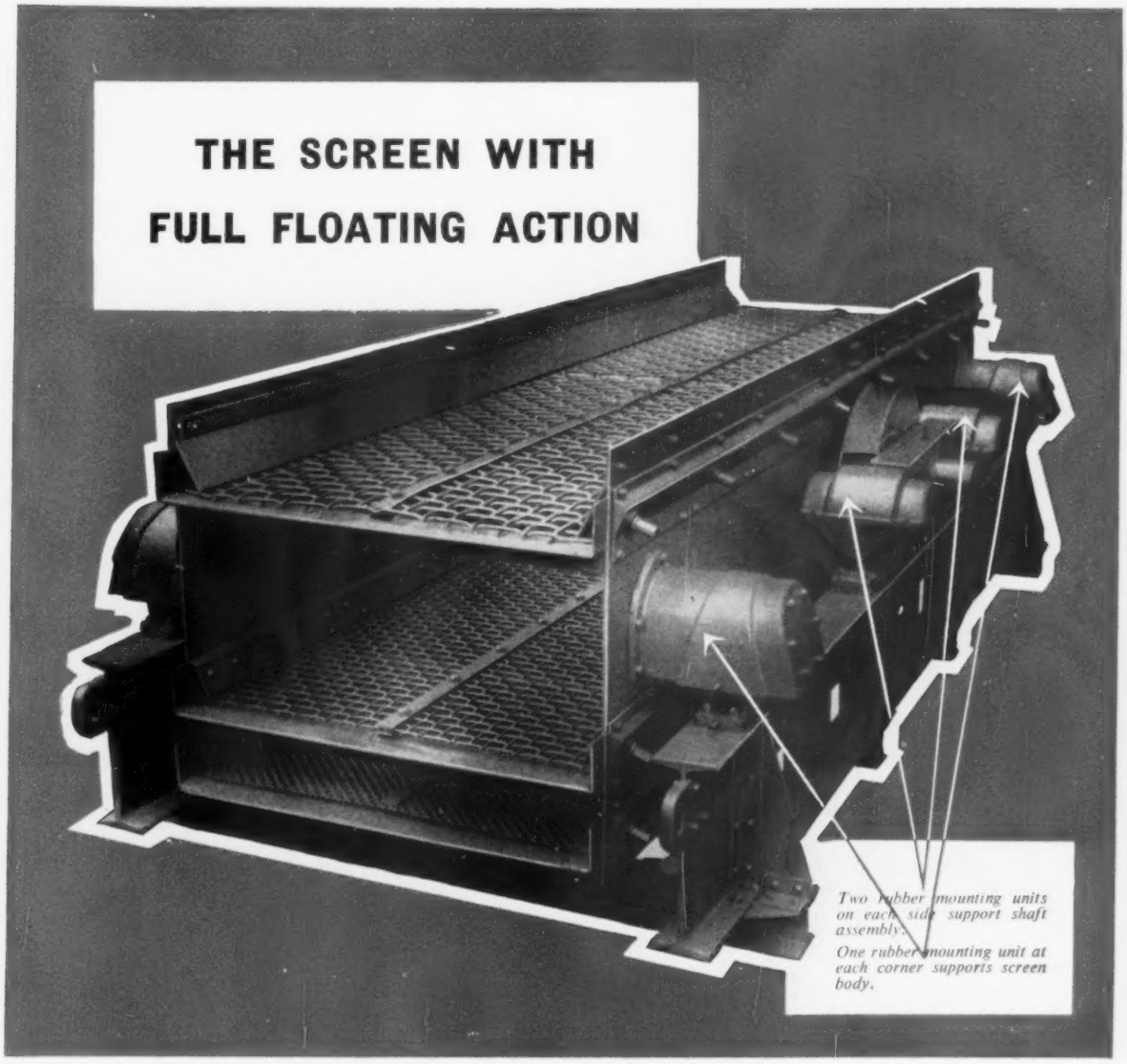
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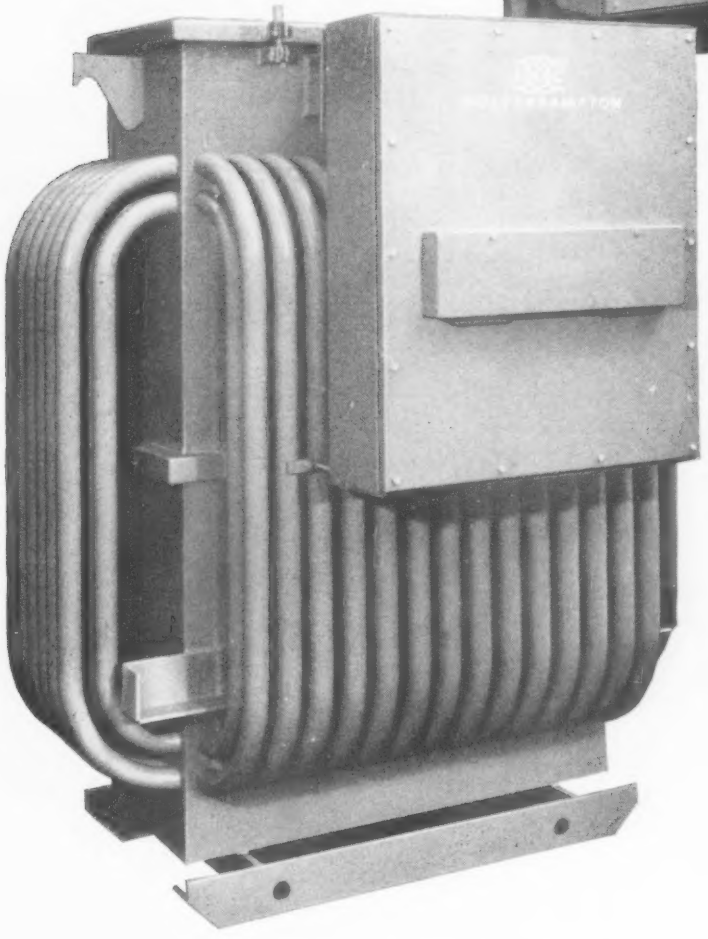

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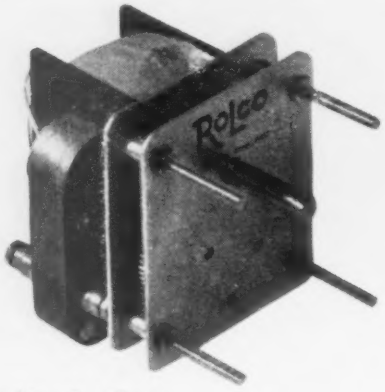

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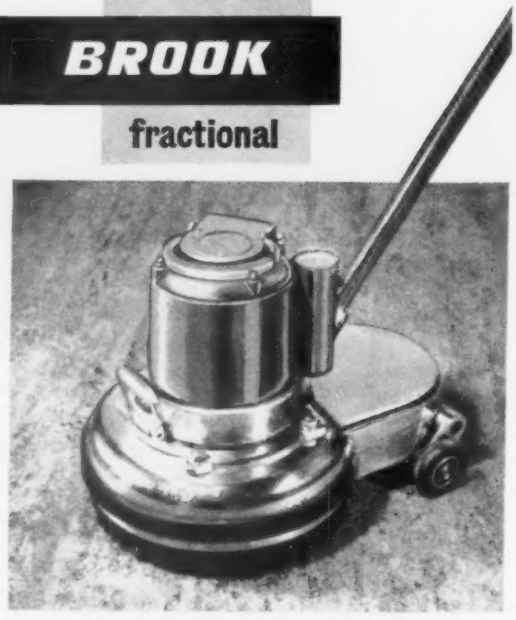

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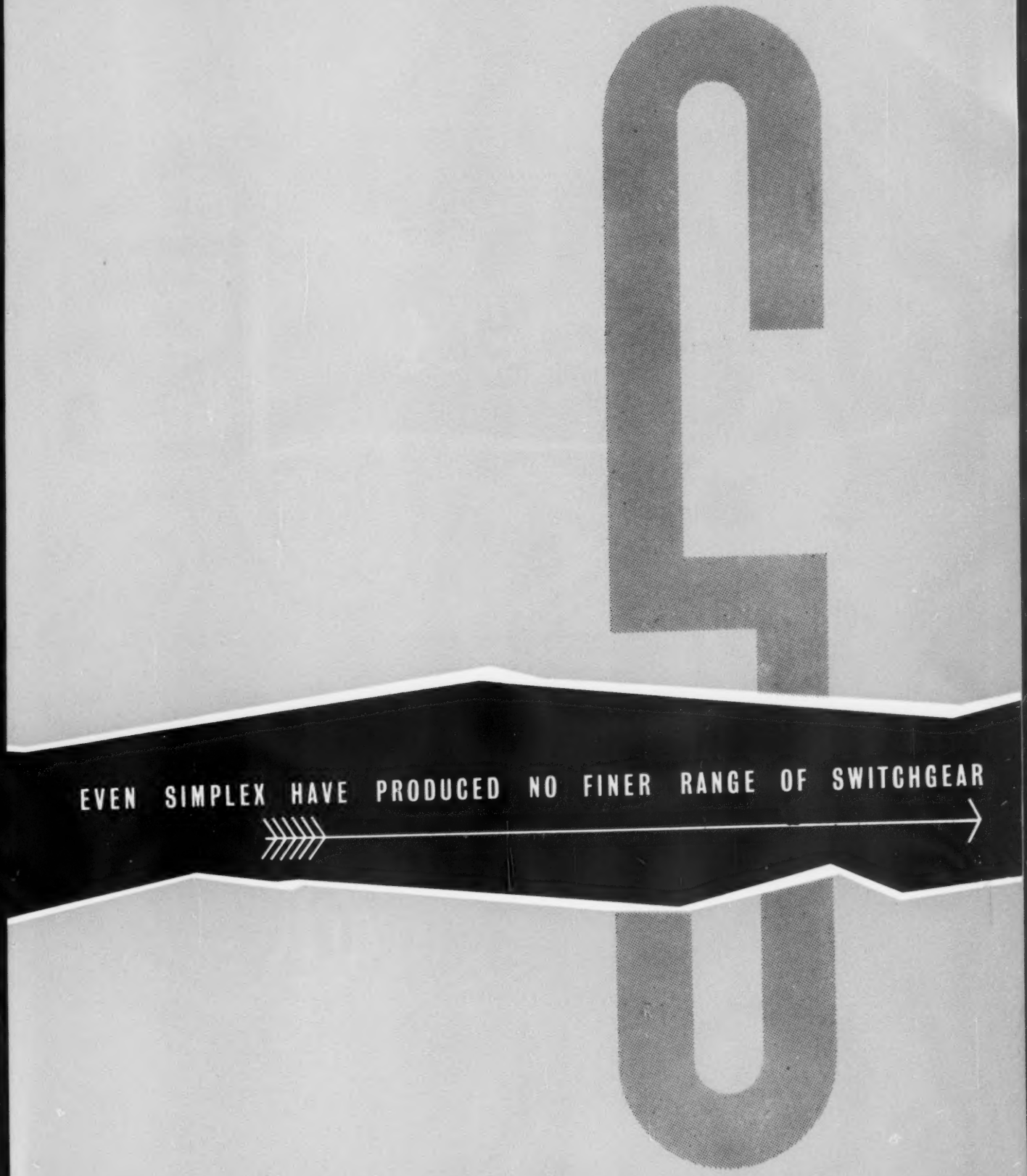
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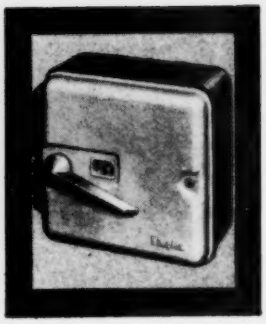

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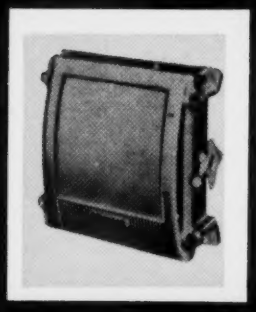
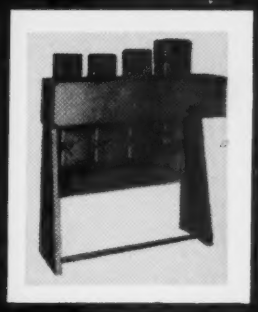
MONARCH





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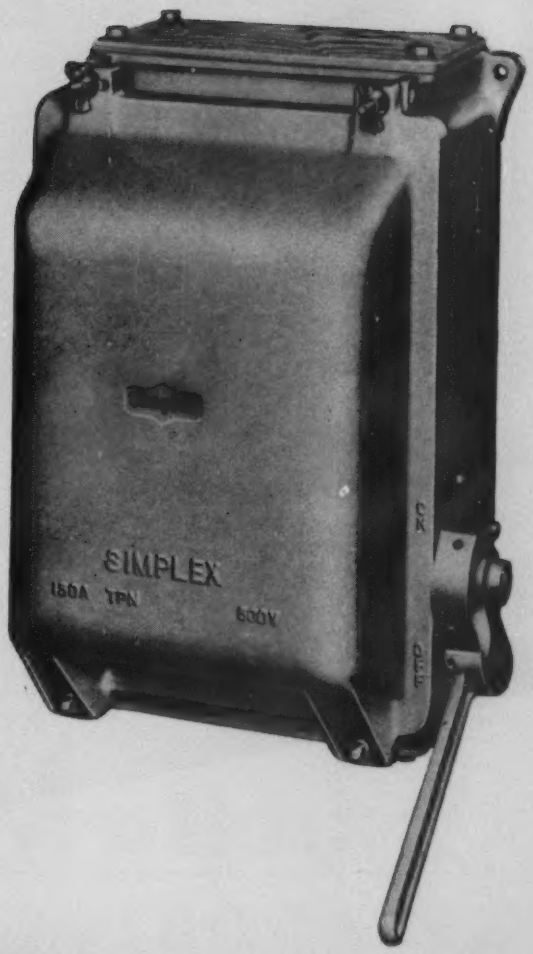

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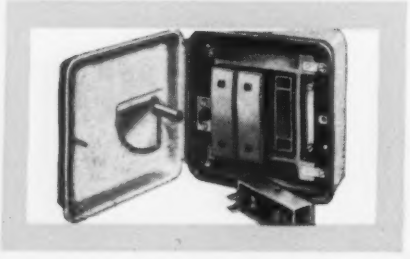

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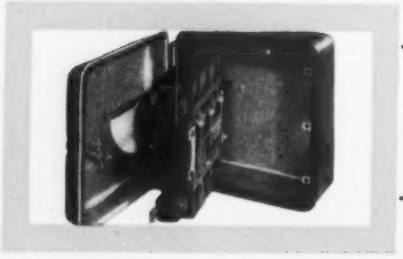

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- Fuseboards are available for surface or flush mounting. They have reversible interiors and cover hingeing, and the fuse banks and neutral connections are provided with circuit identification.
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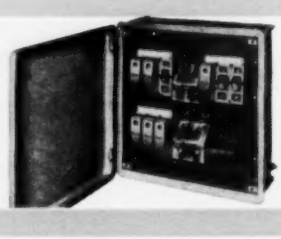
DC 250V. 15, 30, 60 amp.
Busbar chambers and switchboards —
600V. 200, 400, 600, 800 amp.
24", 36", 48".

1. Star switchfuse with cover open and fuse removed to show "dead-front" feature.
2. Star switchfuse with cover open and one-piece interior hinged forward.
3. Star Distribution Fuseboard with cover open; some fuses are removed to show "dead-front" feature.
4. Close up of interior of Star busbar chamber showing main and branch terminals, and busbar arrangement.



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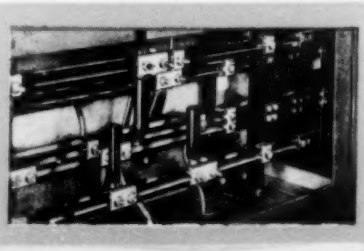
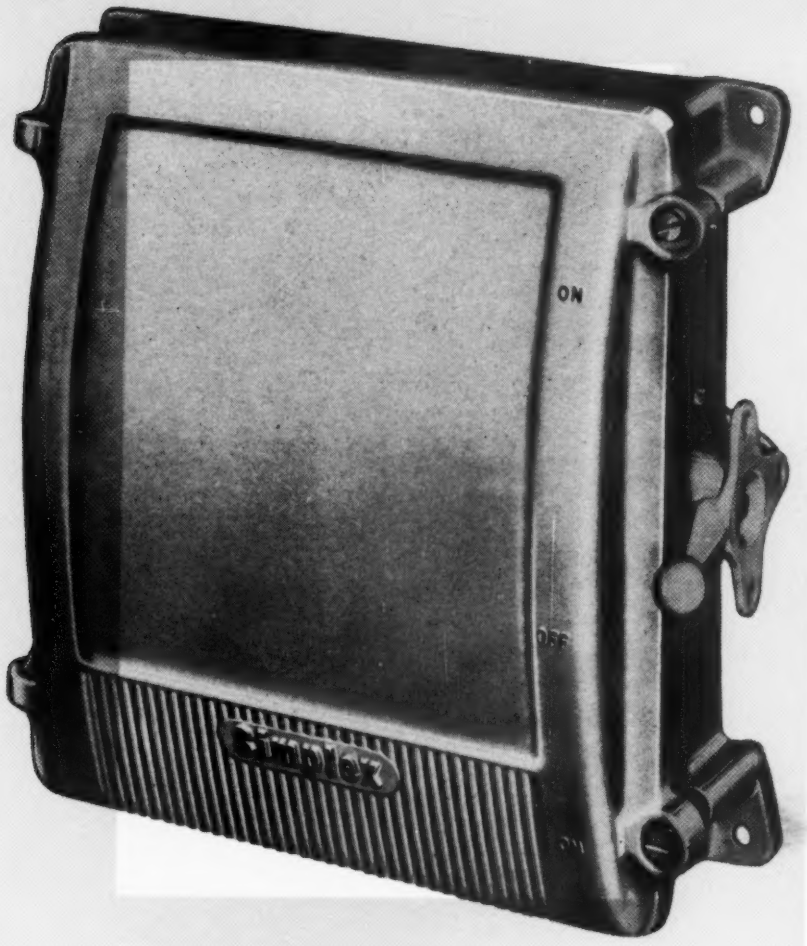




BUILT WITH TOMORROW IN MIND

The Simplex Regent range is robustly constructed of cast iron or a combination of cast iron, aluminium and sheet steel, and is suitable for lighting, heating and power loads without derating.

- Switchfuses accept rewireable fuses of the semi-enclosed type or HRC cartridge fuses.
- Distribution fuseboards are so designed that they are equally suitable for surface or flush mounting. Provision is made for fitting flush barrel locks at any time.
- Busbar chambers are readily extended and all ratings completely interchangeable. They have twin busbars that require no drilling when connecting main and branch connections.
- Switchboards can be assembled to requirements and combined with Simplex 'S & S' automatic control gear, Star and Monarch gear etc.

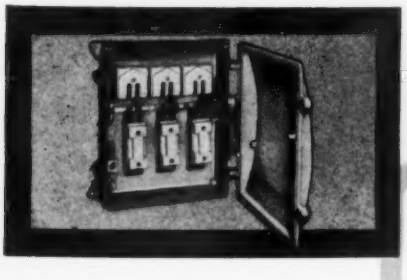
Ratings: Switches, switchfuses, changeover switches.
AC 500/660V. 15, 30, 60, 100 amp.
DC 250V. 15, 30, 40, 60 amp.

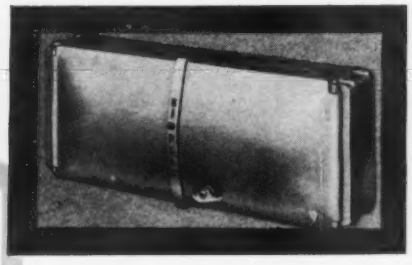
Distribution fuseboards
AC 500V. 15, 30 amp.
DC 250V. 15, 30 amp.

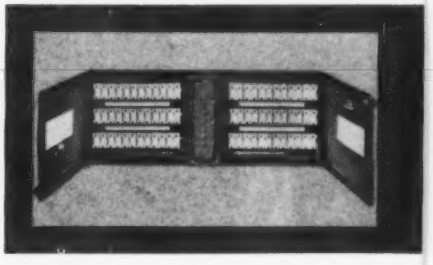
Busbar chambers and switchboards
AC-DC 600V. 350, 550, 800 amp.
26", 35", 44", 53"

Regent

PAGE 6







Left—Regent switchfuse 60 amp. Triple Pole and Neutral.

Centre—12-way, 15 amp. Single Pole and Neutral Regent Distribution Fuseboard. All standard boards can be flush mounted and plaster applied to the edge of the case.

Right—24-way, 15 amp. Triple Pole and Neutral Regent Distribution Fuseboard with cover open showing fusebank arrangement.

MONARCH

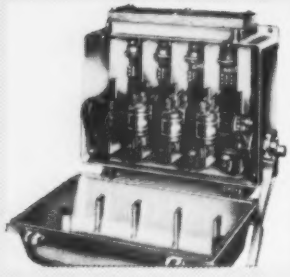
HEAVY DUTY SWITCHGEAR

The Monarch range of weatherproof fuse switches is specially designed for reliable operation under the most arduous conditions.

- Neatly and compactly constructed of cast iron and suitable for all lighting, heating and power loads without derating.
- Excellent wiring facilities provide for ease of installation.
- The range accommodates HRC fuses.
- Provision is made for incoming cables to enter either at the top or bottom of the unit with straight or reverse entries.

Ratings : AC 500V. 150, 300 amp.
DC 250V. 150, 200 amp.

Below—300 amp. Triple Pole and Neutral Monarch fuse switch with cover hinged open to show internal arrangements and interphase shields.



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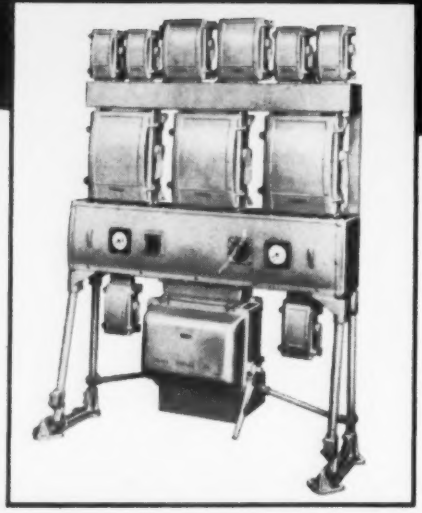

SIMPLEX DESIGN SERVICE

The Simplex team of experts is always at hand to plan installations and to help with your particular requirements. Simplex switchgear units can be combined to form switchboard constructions and adapted to meet particular requirements.

Shown on the right is a switchboard combining Regent and Monarch switchgear.

Simplex

SIMPLEX ELECTRIC Co. Ltd., Blythe Bridge, nr. Stoke-on-Trent, Staffs.

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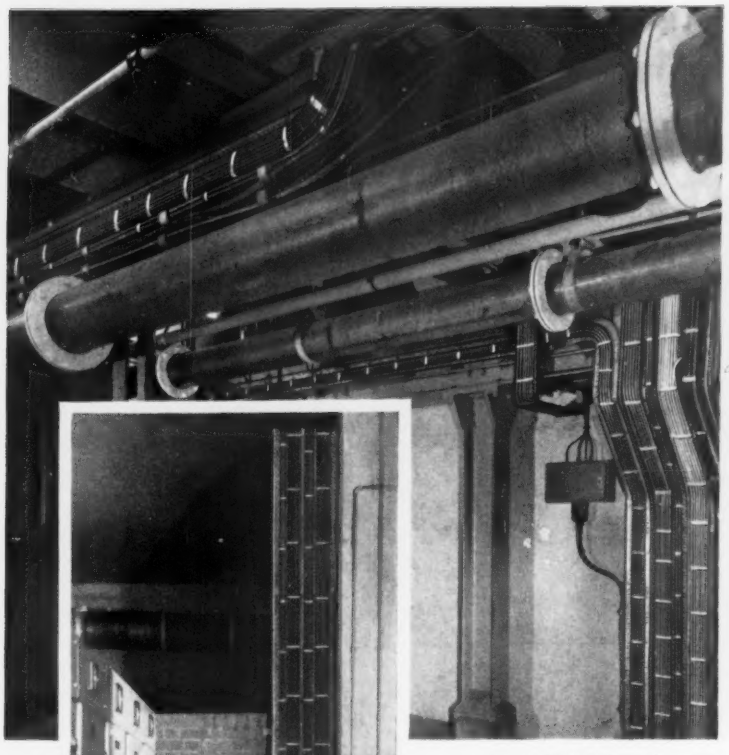
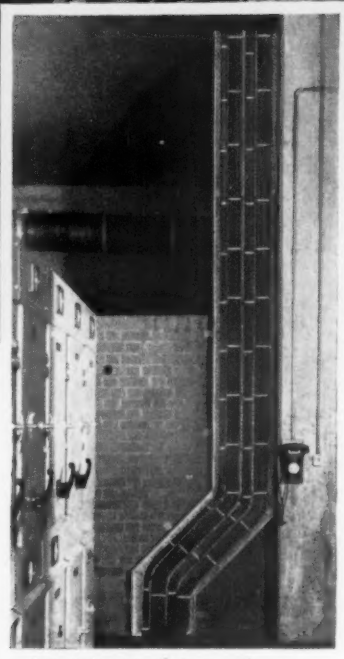
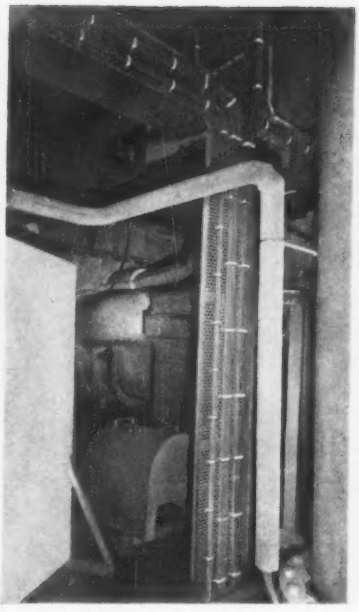




Long bank runs of power and control cables feeding grinder conveyors and situated in 3·3 k.v. sub-station.

No. 6 Machine Room. Pyrotenax control wiring for Super Calendar.



Nos. 5 and 6 Machine Rooms head-box rolls motor control circuits.

Pyrotenax at BOWATERS

The long bank runs and neat short loops of "Pyrotenax" at the Power Station, Paper Machine and Grinder House, of Bowater's Mersey Division at Ellesmere Park, Cheshire are a joy to any electrician's eye. We are proud (but not surprised!) that "Pyrotenax" was chosen for this extremely important industrial installation; some of the wiring has to withstand heat and wet and dirt—conditions that "Pyrotenax" has found perfectly tolerable for years.

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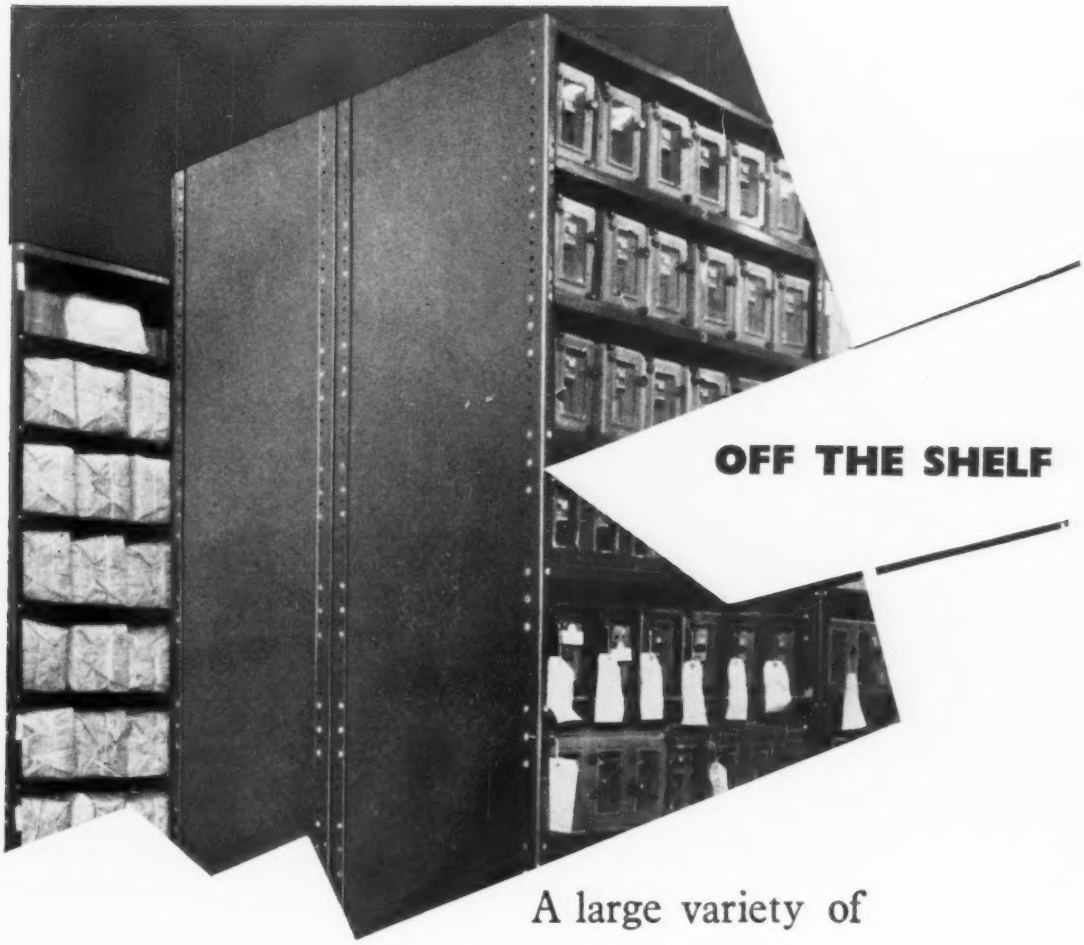

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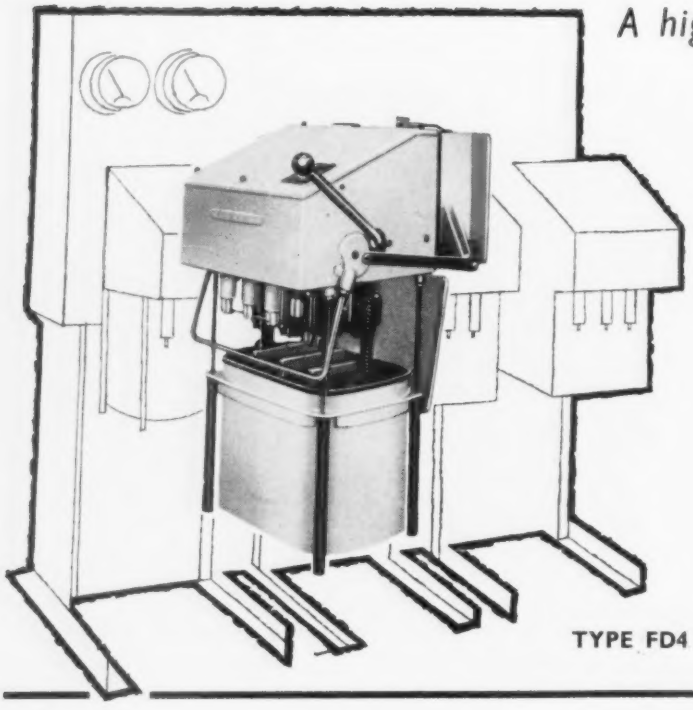

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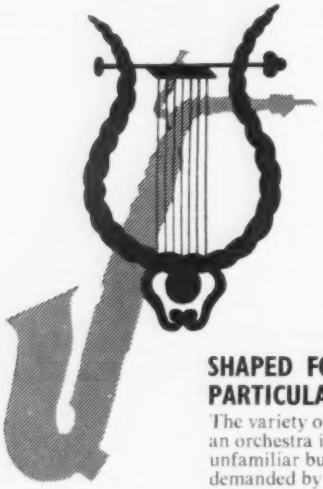

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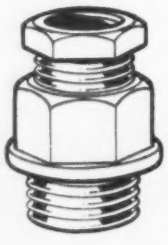

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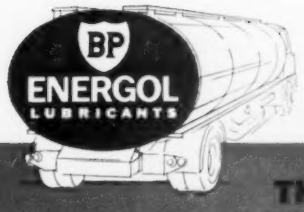

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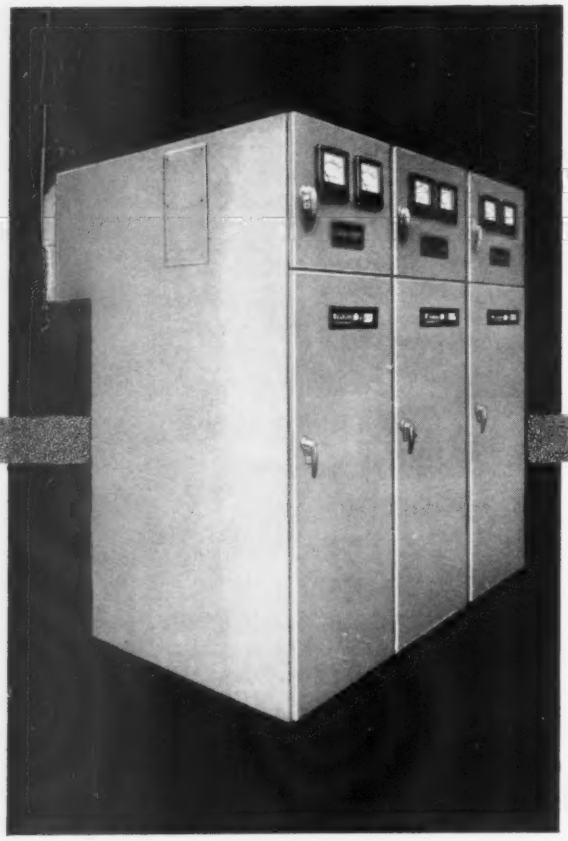

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SUBSCRIPTION RATES: United Kingdom £4, Overseas £4 10s per annum. Canada and USA $12 per annum. Subscriptions are payable in advance and may commence with any issue. Overseas subscriptions may be paid by banker's draft, cheque, international money order or credited to the Electrical Times Ltd., at Coutts and Co., 440 Strand, London WC2. Single copies price 1s 6d. Postage 6d.

Dans ce numéro

Organes Auxiliaires pour Bateux Entraînés par Moteurs à Courant Alternatif 557

On a eu de plus en plus tendance, au cours des dernières années, à passer du courant continu au courant alternatif pour l'alimentation des organes auxiliaires de bateaux. Une des raisons en est l'atmosphère chargée de vapeurs d'huile, existant sur les bateaux, qui rend difficile l'entretien des commutateurs. Ceci permet de souligner les avantages que présente la simplicité du moteur à induction. Deplus on peut aussi utiliser une tension d'alimentation plus élevée et réaliser un gain de cuivre. Cependant les inconvénients de l'utilisation du courant alternatif incluent une commande de vitesse moins pratique que celle possible avec le courant continu; une intensité élevée au démarrage; et le prix relativement élevé des panneaux de commande. Dans le Royaume Uni, l'emploi du courant alternatif a permis de réaliser, jusqu'à présent, une économie de 10% sur les frais d'installation électrique sur les grands paquebots.

Installations Electriques pour Pompes à Essence ... 562

Les recommendations concernant les installations électriques pour pompes à essence dans les stations service, ont été résumées et inclues dans une étude générale des difficultés pratiques que soulève l'application des recommendations officielles britanniques concernant l'installation d'accessoires et d'appareillage dans les installations électriques des différents édifices.

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Un progrès dans l'équipement destiné aux techniciens chargé du contrôle automatique des alarmes, pour les défauts se produisant sur les sous-stations non surveillées, se présente sous la forme de l'indication de la nature du défaut. Quand un défaut se produit, un appel est automatiquement déclenché par l'intermediaire du réseau téléphonique ordinaire, le message correct est choisi parmi une série de messages préalablement enregistrés, et transmi au technicien.

In dieser Nummer

Schiffs-Hilfsaggregat mit Wechselstrommotor-Antrieb 557

Seit einigen Jahren zeigt sich eine zunehmende Tendenz, bei elektrisch angetriebenen Hilfsaggregaten in Schiffen von Gleichstrom auf Wechselstrom überzugehen. Zum Teil liegt der Grund darin, dass die ölgeschwangerte Luft auf Motorschiffen die Instandhaltung von Kommutatoren erschwert. Die Vorteile, die sich aus dem einfachen Aufbau des Induktionsmotors ergeben, kommen dadurch noch mehr zur Geltung. Auch kann eine höhere Verteilerspannung verwendet werden, wodurch Kupfer eingespart wird. Zu den Nachteilen der Verwendung von Wechselstrom gehören eine weniger leichte Geschwindigkeitsregelung als bei Gleichstrom, die hohe Stromaufnahme beim Anlassen und die verhältnismässig hohen Kosten der Schalttafeln. In Grossbritannien wurden durch die Verwendung von Wechstelstrom-Verteillungsnetzen bisher 10 % der Installationskosten in einem grossen Passagierschiff eingespart.

Elektrische Einrichtungen in Benzin-Tankstellen ... 562

Empfehlungen für elektrische Einrichtungen in Benzin-Tankstellen werden im Rahmen einer allgemeinen Übersicht zusammengefasst, die sich mit den praktischen Schwierigkeiten bei der Anwendung amtlicher britischer Empfehrungen für den Einbau von Zusatzgeräten und Apparaten als Teile elektrischer Einrichtungen in Gebäuden beschäftigt.

Fernwirkende Störungs-Signalsysteme für Unterwerke 569

Eine Verbesserung in einem System zur automatischen Meldung von Störungen in automatischen Unterwerken an die Überwachungstechniker besteht darin, dass die Art der auftretenden Störung gemeldet wird. Sobald eine Störung auftritt, wird automatisch eine Verbindung über das öffentliche Fernsprechnetz hergestellt, und aus einer Sammlung von aufgezeichneten Meldungen wird die richtige ausgewählt und dem Überwachungstechniker vorgespielt.

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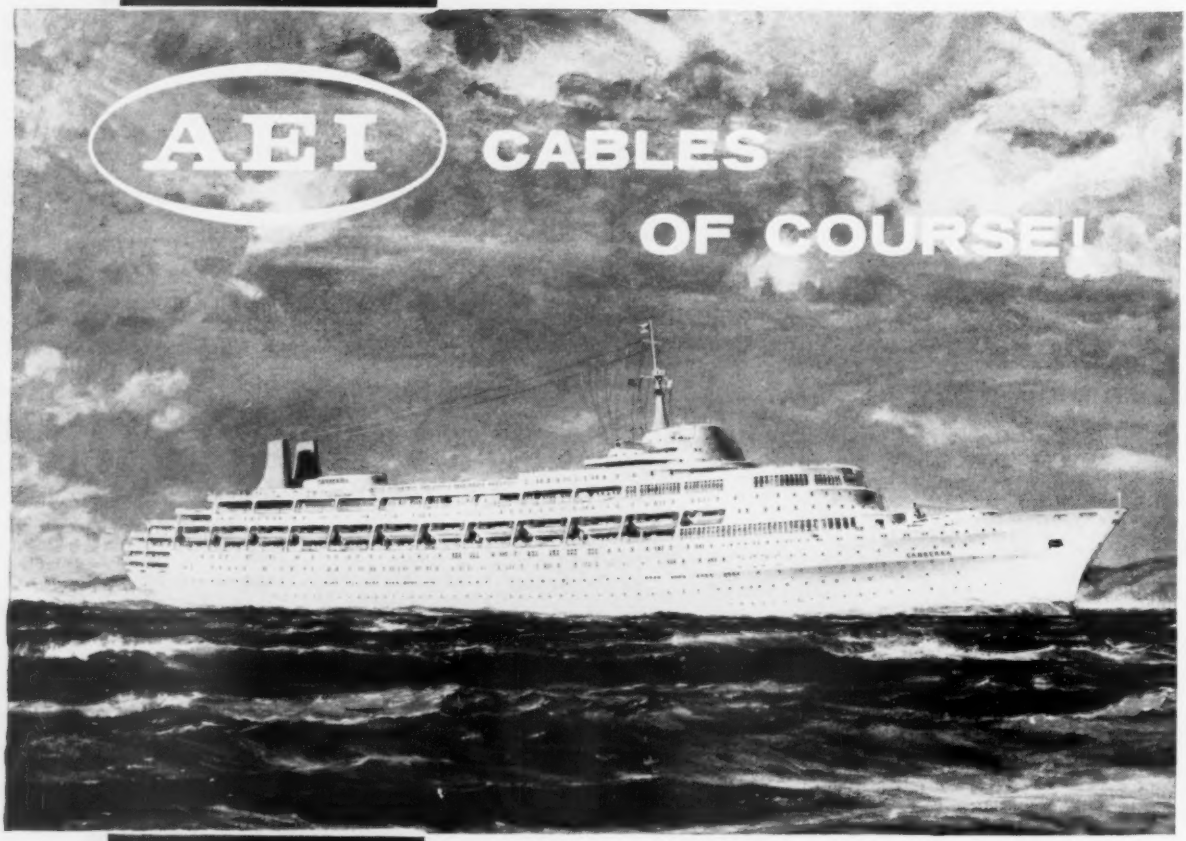

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ELECTRICAL TIMES

ESTABLISHED 1891

THURSDAY, 7 APRIL, 1960

Editor and Managing Director:
ROY BALDWIN, M.I.E.E., Barrister-at-Law

Joint Editor:
K. C. POUNDS, B.Sc.(Eng.), A.C.G.I., A.M.I.E.E.

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Comment

U.S. EVALUATES BIG SETS

How far can the trend towards ever-larger generating sets continue, in the absence of major changes in design technology? An attempt to answer this question provides one of the many challenging papers presented at this year's American Power Conference recently. A detailed cost estimate, based on design studies for 400, 600 and 800 MW unit-boiler-turbine installations (all cross-compound, sub-critical pressure designs), suggests that after taking into account fixed and running charges, even at the relatively low fuel costs applying in the US, development up to 800 MW at least will be economically attractive from the standpoint of total energy cost at the station busbars. The saving comes mainly in terms of capital cost, for the author of the US paper comments that no marked reduction in fuel cost component can be expected. But satisfactory though the overall conclusions are to those planning larger sets, there is a warning that pioneering costs hard cash. American figures for machines already in commission show that there is a "several points" reduction in availability in sets in the top classification of pressure, temperature and rating, while in the class immediately below the top, availability betters 90%. That reflects, on the one hand, the inevitable run of teething troubles that afflicts advanced plant, but also indicates the soundness of the basic designs and the reasonableness of the steps forward they represent. Supercritical installations, it may be noted, are not considered an immediate prospect for the largest sets, although the turbines already in operation on such steam conditions are providing experience on which the necessary advance will be based—perhaps with sets moving to the 1,000 MW mark if system size justifies so many eggs in one basket.

NEW DRIVE FOR EXPORTS

Clearly, Monday's Budget proposals hold no promise for the electrical trade, such as those in recent years have brought. Neither the appliance-buying public nor the capital-plant-expanding industrialist will make major changes in their plans on account of Mr Heathcoat Amory's proposals. The Budget speech reflected faithfully the points already made in the Economic Survey: the need for 1960 is an even larger increase in the volume of exports. One possible difficulty raised in the Survey has been firmly dealt with by the Chancellor. There is no encouragement for a surge in home demand, such as might sap the resolution of manufacturers in tackling overseas customers; indeed, the amber light flashed threateningly when credit was mentioned. The outlook on costs is less certain,

with terms of trade likely to turn against the UK, and the chances of maintaining near-standstill on wages and salaries looking at least questionable. That leaves much to be sought through increased productivity; and here again, the Survey was pessimistic of the chances of maintaining last year's rate of advance. So salesmanship of a high order will be needed if the Chancellor's appeal is to be answered, and the electrical industry make another surge forward in its export achievements which have improved so often over recent years. The Budget changes may be epitomised by their one electrical proposal: to extend to portable electrical lighters the Customs and Excise tax now applying to mechanical lighters.

ALTERNATING CURRENT FOR SHIPS

Ship installations have remained a stronghold of d.c. distribution long after alternating current has become virtually universal ashore. But the tide is turning fast now, and a.c. auxiliaries are becoming the rule rather than the exception. The attention given to the recently launched *Canberra* underlines the trend, which extends to the everyday cargo ship and, to an even stronger degree, to the growing fleets of oil tankers. To provide a background to the new techniques necessarily coming into use, we publish this week the first of a series of articles on a.c. afloat, based on lectures to marine engineers organised at the Royal College of Science and Technology, Glasgow. Although these were intended for specialists, the story they build up holds lessons of importance for the many electrical engineers who come into contact with shipboard practice through supplying equipment for this duty. In the main, it is land practice that provides the basis for the a.c. technique; but the isolated nature and limited capacity of the marine installation impose restrictions on what can be achieved, while the atmospheric conditions at sea and the special needs in port each present requirements on equipment and machinery that do not arise in normal industrial installations. At the back of all the requirements lie Lloyds' Electrical Rules, and it is relevant to remember that these have recently been the subject of a comprehensive revision by the Society's chief engineer surveyor.

CO-OPERATION FOR EUROPEAN SUPPLY

The eight-nation European Union for Electricity Generation and Transmission, whose annual report we note on a later page, is an example of technical co-operation in the international sphere at its best. Formed to facilitate power exchanges across national frontiers, it early decided that it would concentrate on the use of existing lines rather than construct a superimposed, very high voltage bulk transmission grid system. With that policy established, the organisation, working with only the smallest central secretariat, has bent its efforts on aligning technical practice sufficiently to enable it to fulfill the proud boast, that because technical obstacles to such interchange have been removed, it can meet emergency calls for power within a few minutes. This has of necessity involved much co-operation about phasing, control characteristics and protection practice; and it has been brought about partly by a willingness to experiment on a large scale in order to obtain the data necessary to still more satisfactory working. The close co-operation which such work entails has had its usual result in many ancillary activities calculated to improve the general efficiency of power generation and transmission. Working parties established to tackle specific problems of topical importance produce reports of general application, which distil the experience of a large number of undertakings, operating an installed capacity of some 38,000 MW aggregate capacity. An example from the report we review is a code of practice for the preliminary steps in commissioning steam plant; routine, perhaps, but the more significant for representing the pooled experience of a large number of important operators.

DESIGN UNDER FIRE

Engineers do not take kindly to industrial design, their formulae-ridden training makes them look askance at the lack of obvious parameters in aesthetics. There is, however, no gainsaying the need for better appearance design, and Sir Gordon Russell had some pungent criticisms of electrical equipment to put forward in a recent lecture to the Royal Society of Arts. Radio and television sets he condemned as being without form, content or serenity, while in referring to cookers he clearly had a nostalgic regard for blackleaded iron and hoped that manufacturers would devise a finish that had its beauty. Gas cookers, he thought, were better designed than electric ones, but both were flirting with flashy styling to which he applied the word "stupidisation". A good word was said for lighting fittings of the utilitarian type, but often the wrong type of fitting was selected for an installation. On decorative fittings he thought designers had been inhibited by the beauty of the old candelabra. A grudging tribute was paid to the design of concrete street lighting columns but clearly concrete was not a popular material, especially for use in older towns. Throughout his detailed comments, Sir Gordon viewed industrial design as a basic factor, not just a piece of art stuck on at the end, but something arising from the nature of the individual article. Manufacturers, however, may be excused if they regard design not as an end in itself but as something that helps sell their products. In this fashion plays a part, a question which Sir Gordon does not discuss, but fashion or no, sound industrial design has become an essential factor in modern marketing whatever the nature of the goods.

Meteor

This week's quick summary of electrical news faces advertisement page 26.

Alternating current auxiliaries on board ship

by Henry B. Hughes,* B.Sc., M.I.E.E.

WHAT has aroused the comparatively recent interest in the use of a.c. on board ship? What has delayed its use, when one considers the wealth of experience which has been gathered down the years since the change from d.c. on land installations, and most of the problems now associated with marine installations, already solved? Certainly, one of its main attractions, transmission over long distances at high voltage and minimum copper cross-section, does not apply to the same extent on marine installations, but there are other advantages, and it would appear that difficulties now cropping up at sea are directing more attention to a.c. as a means of overcoming them.

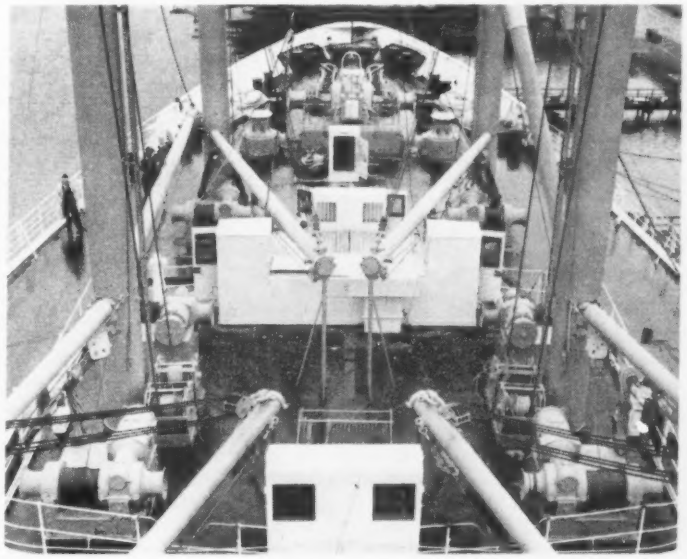
Motor Ships

Until the advent of the diesel engine, installations were mostly composed of lighting with some small units of fans, toasters, etc., the auxiliaries such as winches and pumps being steam driven. When it was no longer necessary to have boilers for propulsion, more and more electric motors were introduced into the engine room and on deck, until the generator capacity went up from 70 or 80 kW to 600 or 700 kW for the average cargo vessel. About this period a few tankers were fitted with a.c., as the problems here were small compared with a cargo vessel, and these installations have given very good service indeed. But the size of installation kept on increasing until passenger ships of the present day have a generating capacity of 5,000 to 7,000 kW, and are now such as lead to a more serious consideration of the claims made for alternating current.

The motor ship has been a mixed blessing. It has certainly provided the electrical engineer with motor-driven auxiliaries, a readily available source of power, but it has brought an oil-laden atmosphere which, drawn in by the motor ventilation fans, soon deposits a greasy mixture of oil dirt and carbon from the brushes on windings and commutators. Even with the best attention, it is very difficult to keep faults under control and as very often the care taken is negligible, commutator troubles are bound to develop. These are annoying enough when they occur in a British port, but in a foreign port the repair charges are excessively high, and on occasions after the repair the machine breaks down again on the way home. Some would maintain that this is the main reason for the awakened interest in a.c.

For what could be more robust than the squirrel cage motor with its rotor of effectively solid copper, no commutator, and its ability to run for long periods with very little attention? That it has its drawbacks will be shown later on, but it was felt that if the a.c. motor could be adapted to fulfil approximately the same duties as the d.c. motor, commutators could be abolished or considerably reduced and the saving effected would make a.c. worth while.

Another great advantage of the s.c. motor is its ability to stand direct-on switching to line without risk of damage to windings, whereas in the case of d.c. machines, the insertion of current-limiting resistances in the starter renders the latter more bulky, complicated, and expensive. There is no reason why every a.c. motor on the ship cannot have direct-on starting provided there is sufficient generator capacity to keep the consequent transient voltage drop within the maximum of 20%, but there is an economical limit to the generator capacity for a given installation. This capacity can handle all but a few large motors and it is then necessary to consider star-delta or auto-transformer starting or double or triple windings for such motors. All are more expensive than the direct-on starter, and the multi-winding has the effect of lowering the power-factor, but these drawbacks are fully



General view of the forepart of the RMS "Amazon," showing Ward-Leonard cargo winches. (This vessel is owned by the Royal Mail Lines Ltd., and was built by Messrs Harland and Wolff. Winches, windlass and capstans are by Clark Chapman and Co.)

* Mr Hughes is Electrical Manager of Messrs A. Stephen and Sons Ltd., shipbuilders, of Glasgow S.W.1. The article is the first in a series based on lectures given in the Department of Electrical Engineering at the Royal College of Science and Technology, Glasgow, under the title "The Use of A.C. for Auxiliary Machinery in Ships." We are indebted to Mr J. T. Pender, B.SC., A.R.C.S.T., A.M.I.E.E., for help in assembling these articles.

compensated for by the reduction in size of the generating sets. We must not forget, however, that the starting current of a s.c. motor thrown direct-on the line is five to six times f.l. current and if such starts are frequent another problem is raised. Still, the direct-on starter does save weight, space, money, and maintenance.

Distribution Voltage

Although it was mentioned earlier that the advantage of transmission at high voltage does not apply to anything like the same extent on board ship, there is a saving in cabling costs on going from 220 V d.c. to 440 V a.c. Theoretically for any given power and per cent voltage drop, the cross sectional area of the copper conductor is inversely proportional to the square of the voltage, but full advantage cannot always be taken of voltage drop. The cables are rated on temperature rise, and the load is very often at less than unity power factor. Also any saving there is, is confined to the 440 V circuits. Again, there is a reduction in copper content in the 440 V alternators and motors as compared with their 220 V d.c. counterparts.

Where various voltages are required for power, heating, lighting and navigational aids, a.c. is especially suitable due to the simplicity of transforming at high efficiency, but the advantage of the higher voltage is somewhat offset by the cost of these transformers. On the other hand if different voltages on an a.c. supply are required on a d.c. installation, motor-generators with their losses would have to be employed. So we cannot debit all the transformer cost in a comparison.

It is only fair to add here that Lloyds rules permit voltages up to 500 V d.c. for power, and the comparison should therefore be between 440 V a.c. and 500 V d.c. Many years ago a few installations at 440 V d.c. were carried out, but they did not become popular due to insulation and commutator troubles amongst other things. Probably they were before their time, and in the author's view, investigations along these lines might be fruitful.

Most d.c. lighting is effected with tungsten lamps, but a.c. now offers a further choice of fluorescent, mercury vapour and sodium lamps. Consider fluorescent lamps. An 80 W tube (paradoxically enough, it takes about 100 watts from the line) gives about the same lumen output as a 250 W tungsten bulb, it has no filament to shatter through vibration, its life is in the region of 3,000-5,000 hours against the tungsten life of 1,000 hours. Long tubes at high voltage and various colours can be twisted and arranged into very artistic designs in large or even small public rooms. On a passenger vessel recently built, the cocktail bar was very effectively designed round the lighting.

In addition to the reduction in the lighting load, the heat from tungsten lamps in decorated space can be considerable, with consequent increased capacity required in the air conditioning plant.

A.C. Disadvantages

The factors discussed above are the advantages claimed for a.c. but unfortunately there are also drawbacks such as:—

1. Speed control of auxiliaries.
2. Lack of suitable a.c. deck machinery.
3. High kVA loading on starting the large auxiliaries.
4. High cost of switchboards.

Probably the one factor more than any other which has delayed the acceptance of a.c. for ships is the fact that the a.c. squirrel-cage motor is a more or less constant speed machine.

Of course there are variable-speed a.c. motors, but they introduce additional cost, commutators, running losses or reduction of torque and power factor. A limited amount of speed variation can be obtained by (a) star-delta control gear (b) pole changing (c) induction regulators or (d) insertion of series resistances. All of these, of course, add to the cost and the ideal would be a simple induction motor with direct-on start, but engineers and owners for a long time maintained that variable speeds were necessary for such units as ventilation fans, s.w. and oil circulation pumps. They have now accepted compromises such as baffles, by-passes and throttling to overcome practically all the difficulties. If necessary, resort can be made to star-delta connections, induction regulators, etc., but these cases should be very rare. It is a different matter when we come to consider the winches.

It is, of course, engine-room auxiliaries that are referred to above.

The Winch Problem

The winch problem in the author's opinion was the hardest handed to the a.c. enthusiast to solve, when it is considered that the d.c. winch gives a variety of load speeds and a light hook speed of around 400 ft/min. By electrical means alone, with d.c. it is possible to lift half the load at double the speed, have a very low inching creep, and except on overloads, the current is kept within the capacity of the generating sets. The standard speeds are usually: 3 tons at 100 ft/min; 1½ tons at 200 ft/min; light hook 250 ft/min.

These are, of course, the top speeds, but there are also three or four intermediate speeds obtained on different controller steps by the insertion of resistances or diverters. The speeds of the 5 ton winch are lower for the raising duties but the l.h. speed is up round the 400 mark.

Now the a.c. squirrel cage motor is a constant speed machine, independent of the load. If a speed of 100 ft/min were selected for full load, the speed remains the same within a rev. or two for any load up to full load, and the light hook speed would be no higher than 100. To have a higher light hook speed would mean a higher full load speed, and consequently a higher-powered motor unless resort is made to a further development.

One easy solution is, of course, to install a motor generator or generators to supply the deck auxiliaries alone, but is that a satisfactory one? Quite a few ships are fitted out in this way, but we are back again among the commutators and additional losses due to the motor-generator apart from the extra expense. The Ward-Leonard system was considered, but the same arguments against it were used, except for windlasses and capstans which have special characteristics, for which the Ward-Leonard system has most support. Quite a few Continental ships are using squirrel cage motors for windlasses, but in the author's opinion, it would be wiser to stay with Ward-Leonard for the time being.

However, after serious consideration, owners are gradually agreeing that perhaps the light hook speed is not so important after all. Very often the winch has not had sufficient time to get up to the l.h. speed before swinging in for lowering, and compared with the waiting time in loading and unloading the few seconds saved are negligible in an average lift of 40/50 ft—also remembering that the rate of acceleration of an a.c. winch is higher than the d.c.

This concession has been a tremendous help to the winch manufacturers, and using an s.c. motor, two solutions have been put forward.

1. A spur-geared winch, where the motor runs at constant speed and speed variation is obtained by gear changing and the star-delta starting.

The following speeds are obtained: 3 tons at 130 ft/min (5 tons at 80 ft/min); 2 tons at 200 with gear change. Star-delta gives two speeds, hoist or lower. Star connection gives 1/3 f.l. torque and delta 175%, and the footbrake is used for breaking out.

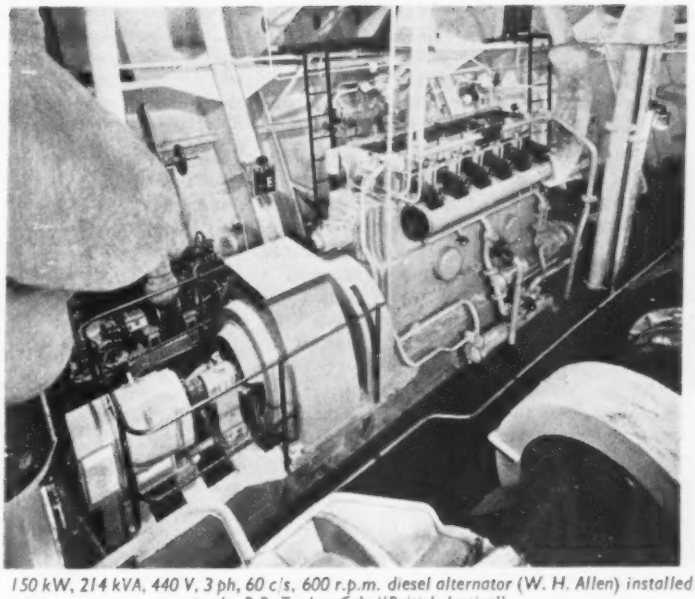
2. A pole-changing winch where the stator windings can be connected in two or three different circuits, thus giving two or three different numbers of pole pairs and hence two or three different speeds. One of these has speed ratios of 8: 2: 1 and the pole changing can be done during the lifting or lowering operations. Speeds are 30 ft, 120 ft, 240 ft/minute.

These winches have been tried out with a considerable amount of success over some years now.

If the claims made by one Continental manufacturer, based on experience, are accepted, the personnel handling these winches consider it easier to handle loads with rope speed independent of control. Also the number of heaves per hour with both empty and half-loaded ships are greater with a.c. than d.c.—figures like 82 against 70, 120-102 respectively—the average lift being just under 2 tons. These results are obtained due to the superior acceleration of the a.c. winch. In this country, there has not yet been sufficient experience to confirm these statements, but indications so far support them.

As regards windlass and capstans, these have special torque-speed characteristics of their own, and although on the Continent some smallish a.c. units have been fitted, the general practice seems to be to hold to Ward-Leonard system of control, even though more space is required.

Ventilating fans either have double-wound motors, giving two or four speeds, or have baffles fitted in the trunking.



150 kW, 214 kVA, 440 V, 3 ph, 60 c/s, 600 r.p.m. diesel alternator (W. H. Allen) installed in the B.P. Tanker Co's "British Justice"

Starting Problems

It was mentioned earlier on that one object was to save space, maintenance and capital outlay by the use of direct-on starters, and assuming we have sufficient generator capacity, there is no reason why the largest auxiliary cannot be switched direct on line.

It has to be remembered that when a heavy load is thrown on to an alternator, there is a transient voltage drop, and the generally accepted maximum is 20% owing to the danger of starters for auxiliaries already running, dropping out due to under-voltage, and also to the annoying light flicker which would occur. Of course it would be uneconomical to increase the generator capacity just to take care of one or two large units, so that star-delta or auto-transformer starters may have to be used for such cases. On tankers the problem is not so acute, because the large deck auxiliaries (i.e. cargo pumps, winches, windlass, etc.) are steam driven, and sudden loads of large volume are less likely to be thrown on and off the alternators. A conventional type of machine with exciter and a common or garden type automatic voltage regulator is all that is required for a tanker because the transient voltage drop has not the same importance. With a dry cargo ship with say 18 winches, there is a completely different picture.

With 18 winches the alternators are subjected to continuous heavy kicks (winch motors being in the region of 25/42 h.p. with starting current five times full load current) and if there is not a short recovery period, the position would be aggravated by the slower starting-up of the motor and longer duration of the heavy currents, danger of drop off of starters, etc. Just how often these kicks occur and how frequently they coincide was up to now a matter of conjecture, as nobody had gone to the trouble of making a time and motion study of the rate of working dockers. There is one obvious good reason why not, but there are other factors which have to be taken into account.

1. Tides and height of lift.
2. Number of hatches working.
3. Rate of working in international ports.

We may be inclined to follow Lloyds rules which would seem to accept a diversity of 33⅓% in the above case, but we would not necessarily be right, as this diversity factor applies only to cable rating. Cable rating is based on temperature rise, and as the heavy currents are only intermittent, it is possible the number of winches working could be more than six and the temperature remain inside the limit. But more of that later. The suggestion from some sources was to provide generator capacity for not 33⅓%, but at least 50% to handle the winch load, as with so many unknown factors, it was better to be safe than have to fit another alternator later on, without having the space to put it in. Working on the laws of probability, it was reckoned that an average of three winches could be working together lifting full load with possibly four or five lowering or on light hook. This was coming very close to Lloyds' diversity factor but a small safety factor was added to this. However, Continental builders who have more experience than we have, having fitted out more than 200 ships, started off with an ample safety margin on their alternators but have gradually reduced this until they now state that a.c. alternators need be no larger than d.c. In fact some are smaller. Notice that power is discussed, that is kW, as with the large reactive kVA of winch load and heavy currents at power factors less than unity more copper may be needed for the alternator to keep within the temperature rise but *the size of prime mover is not increased.*

Now with this continuously varying winch load and the strain placed on the alternator, the conventional machine was considered to be wanting in voltage regulation and quick response and the search was on to find an answer in the alternator itself, as the a.v.r. can only restore the voltage and cannot affect the transient.

The alternator may be designed with a lower reactance and thus reduce the transient volt drop, but this increases the prospective short-circuit current which, as will be seen later on, is becoming more embarrassing as the size of installations increase. It was thought necessary to introduce a load-dependent component into the magnetic circuit; and a great improvement in performance resulted from the use of magnetic and electronic a.v.r's controlling the field of the exciter. These, however, were expensive and also suffered from the time delay on the part of the exciter (as well as another commutator), and attention has now turned to the self-excited compound alternators. With an arrangement of transformers and rectifiers handling voltage- and load-dependent components of the excitation current, the transient volt drop is reduced to about half the previous value with a recovery period from 0·1 to 0·35 second to ± 2½% of normal voltage. No commutators or moving parts are involved, and the exciter is omitted with corresponding reduction in alternator length, (although provision has still to be made for the housing of static exciters). Such alternators have now been in use for some time and have given satisfaction so far.

Any light flicker due to the constantly varying winch load can be remedied by fitting a motor generator for the lighting circuits.

Protection Problems

We will deal here with a point which will doubtless be mentioned not because it applies only to a.c.—we have it in d.c. even more so. Due to the increase in the size of installations and generator capacities, there is danger that the rupturing capacity of the protective devices may not be sufficient to cope with the prospective short-circuit current with which they may have to deal. Take a simple example, say a 500 kVA alternator with 12½% reactance and a dead short occurring across its terminals. The short circuit current would be in the region of 4 MVA so the circuit-breaker has only to cope with breaking or making 4 MVA. Even with four machines on the board and the fault on the wrong side of a feeder breaker, the fault level is only 4 MVA × 4 = 16 MVA. Standard breakers are capable of dealing with this as the rupturing capacities are 15 MVA, 25 MVA and 35 MVA. However, supposing we are dealing with a large passenger vessels with say four machines at 1,500 kVA and the same reactance, the fault level would be 48 MVA. This is beyond the largest standard rupturing capacity and the circuit-breaker manufacturer would have to be advised accordingly. So it is more important to keep an eye on the feeder rather than the main breakers. If the fault level is high, it may be necessary to have back-up h.r.c. fuses so that if anything unforeseen happens the fuses will step in and clear the circuit, or a sectionalisation of the bus-bars interconnected by reactances. Of course, the farther from the switchboard, the lower the fault level due to the resistance and reactance of the circuit.

It has been suggested that generating at a higher voltage, say 3·3 kV, would solve the problem of rupturing capacity in addition to the saving of copper in cabling, etc., and although this would require careful consideration, it is quite a possibility in the near future for large passenger ship installations.

Of course, this higher voltage would not be new on board ships, as 3·3 kV is common for electrical propulsion, with correspondingly smaller cables for the power transmitted, which can be easily tucked away, taking up little room in the most convenient position. The tunnel space is saved, manoeuverability is at its maximum, and the stresses and strains taken normally by the long shaft are now handled by the electric field of the propelling motors, which can be broken but is readily re-established. The same field acts as a brake on racing of the propellor, and the whole system of motors, and alternators acts as a cushion to sudden loads being thrown suddenly on the prime movers.

Conclusions

The saving in first cost, in this country at any rate, has not yet been realised to the extent expected by the a.c. advocates. There is a saving of about 10% overall in the case of a large passenger vessel, approximately the same outlay for the average cargo vessel, and a slightly higher one for the smaller ships: but this may be due to the fact that, being an innovation, manufacturers are not yet geared up to an economic production. Pump design could be looser with d.c. and any deficiency easily corrected in the variable-speed motor with little loss in electrical power, whereas the fixed a.c. synchronous speed allows little margin and for maximum output and power factor, the designer will have to be more exact in his calculations. In fact it could mean considerable alterations to his standard frame sizes, but if the demand grows in the marine field, the right article will be produced. A considerable reduction in maintenance is expected but only experience can tell just how much.

Certainly on the Continent and in America, a.c. installations have made larger strides, and it may be our conservative attitude of "Show-me-before-I-buy" which has delayed development in this country, but there is no doubt of the considerable interest that has been shown in the last few years in shipbuilding circles. Orders for quite a few cargo vessels with a.c. winches have been recently placed, and their performance will have a considerable influence on the future of a.c. at sea, as far as the British Isles are concerned.

Co-ordination on Education

CO-ORDINATION of activities of electrical and electronic equipment manufacturers in the fields of education and training is the object of the setting up of a joint education board of trade associations representing the two sides of the industry. Associations represented on the new board are to be: BEAMA, BREMA, BVA, EEA (Electronic Engineering Association), RECMF, SIMA, and TEMA. The independent chairman of the board is Col B. H. Leeson, former director of BEAMA.

The new board will act for both industries in matters of common interest, although it will be left to each trade association to act for its members on matters special to that association alone. The board will promote educational and training activities generally, act for the members in discussions with professional institutions, government bodies and the like, provide an information centre, and concern itself where appropriate with exhibitions and conferences.

Further information about the new board may be obtained from Mr J. Oldroyd, secretary of BEAMA.

Outlook for Trade

THREE MONTHS OF COMPANY REPORTS AND FORECASTS

WEEK by week reports of the trading activities of electrical companies are published and summarised in our pages and individual chairmen give their views of the immediate prospect before the firms concerned. While such information is of immediate interest to the shareholders for whom it is intended, and perhaps also to the firm's competitors, the reports do not perhaps receive the overall attention they deserve. It is felt that a worth-while picture could be built up from a group study of the information made available.

The company results themselves have been analysed in the accompanying table under four broad classifications: consumer durables, light engineering, medium engineering and heavy and general firms. More detailed classification gives rise to difficulty, particularly with the increasing trend towards larger company groups and even the classification adopted includes some overlapping.

The reports studied are those that have been published in the three months from January this year. Unfortunately the periods covered are not identical but all reports published in this period and relating to years ending earlier than September 1959 have been disregarded. The basic parameter chosen for comparison has been the trading profit expressed as a percentage of the capital employed in the business; definitions of the terms are given in the footnotes to the table. Percentage increases in capital and profit are also given as well as variation in stocks and work-in-progress. The figures reproduced underline the major increase last year in the consumer goods field and reflect the higher capital requirements of the heavier sections of the industry. The position with regard to stocks and work-in-progress is specially significant.

Such reports record past performance, it is in the several chairmen's views that an expression is obtained of what the current year may bring. Broadly they reflect very much what is said in general terms in the Economic Survey which the Government published last week. This states that total fixed investment income demand will rise at least as fast in 1960 as last year and it seems probable that consumption will rise rather less during the year than in 1959. Within that overall view there can be many variations some of which are suggested in the following summary of forecasts made by individual chairmen.

Financial results of firms reporting in first quarter, 1960

	Consumer Durables	Light Engineering	Medium Engineering	Heavy and General
Profit as % of capital*				
1958 Av. ...	48·5	30·8	19·3	11·9
,, Max.	57·2	45·8	41·3	20·2
,, Min....	18·2	23·3	17·2	10·6
1959 Av. ...	65·2	29·5	21·3	11·1
,, Max.	77·4	55·6	30·9	12·6
,, Min....	12·4	18·7	6·2	7·5
1958-59 % change in				
Stocks† ...	+22·8	+21·0	− 3·7	+ 2·4
Capital* ...	+24·2	+30·4	+ 2·7	+12·7
Profit* ...	+67·0	+21·0	+ 1·3	+ 5·0

*Capital is total used in business including reserves, overdrafts, etc., but excluding investments. Profit is before deduction of depreciation, etc., but excludes investment income.
†Stocks include work in progress.

What Chairmen Say

In the consumer goods field there seems common agreement that the rate at which sales climbed in 1959 will not be repeated in 1960, and although there is general expression of confidence in scope for expansion, productive capacity is now becoming excessive in some ranges and grossly excessive in others. Profit margins will undoubtedly be lower and prices keener. Imports have added weight to competition and 10% of washing machine sales and 8% of vacuum cleaners sales are of foreign make. More optimism is expressed in the refrigerator field with the belief that the favourable position will be maintained and for commercial units the market is expected to continue buoyant. For tape recorders the profits continue to improve. Referring to the European market, some benefit is hoped from the relaxation of import restrictions in France. Italy seems headed for a period of industrial expansion with sales making considerable strides.

Striking advances are reported in the electronics field with every hope of continued expansion but the outlook for instruments is less assured and although there is an air of confidence, it is heavily qualified. For capacitors, demand is likely to continue over all sections.

In motors, an upward trend in demand is reported with every prospect that it will continue. A steady improvement which gives cause for optimism is experienced by one firm making control gear and other equipment. Lower profit margins are anticipated through reduced prices on some lines, but it is hoped that compensation will be obtained from a larger market. Another firm in a parallel field is less hopeful in face of competitive conditions and no return is foreseen to the very favourable trading conditions that have existed for some years. A specialist firm in this class does not expect production during the current year to attain the record reached last year.

Naturally it is from the cable industry that the most depressing story comes. It is suggested that the emergence of price leadership may repair the damage resulting from the chaotic conditions of the last six months of 1959. However, as mains cable contracts have been made over long periods at low prices, it will take up to two years to restore price levels to a figure offering reasonable return.

A slight but encouraging rise in world trade in 1959 is reported and economic indicators point to a further rise in activity in 1960 but this seems slow to extend to capital goods and exports are secured only at prices disappointingly low. After a far from good year, one firm reports 80% more orders than in 1958 mainly for large transformers and turbo-alternators; in the medium range the increase was only 20%. Even though this firm started 1960 with 50% more orders on the books there will still be an excess of productive capacity during the year.

Common installation faults

SECTION 3 OF I.E.E. WIRING REGULATIONS IN PRACTICE

by E. J. Sutton*, M.I.E.E.

IN concluding Part 2 of the author's previous article* mention was made that another occasion might be found to publish further explanatory comments on other sections of the IEE Wiring Regulations. The present article represents a further instalment in the practical interpretation of the Regulations. From letters that have been received from individual instructors and from technical colleges, it would appear that the National Inspection Council's experience in the field is tending to concentrate attention on certain of the Regulations which have been somewhat glossed over in the past. The comments put forward in this article, as in its predecessor, are offered in the hope that they will lead to a greater and more uniform understanding of the requirements of the IEE Wiring Regulations. They are concerned essentially with their practical application to the work on site.

The control, distribution and excess current protection provisions of the Regulations (Section 1) were dealt with in the earlier article, as was the installation of conductors and cables (Section 2). It is now proposed to comment on some of the common faults encountered during the Council's inspections concerning Section 3—the installing of accessories and current-using apparatus.

Section 3 Regulations

Reg. 301—Voltage rating of apparatus. The requirements for all apparatus to have a voltage rating of not less than that of the applied voltage (as read on a voltmeter) are clearly stated in sub-clause (A). It is sub-clause (B) that is subject to misunderstanding, particularly in respect of assembly on site of composite switch and fuse gear panels. Note 1 should be studied very carefully in conjunction with this sub-clause and the requirements that have since been clarified in the sixth issue of Abstracts of Interpretations of the 13th Edition, but merit repetition for the purpose of this article.

Where the outgoing wiring from single-phase fuse gear is housed in the same conduit, trunking, duct or other enclosure, as wiring connected to a different phase, the single-phase fuse gear concerned must be rated for the maximum voltage difference between phases, i.e., for the standard 415/240 V three-phase four-wire system, the protective equipment must be rated at 500 V.

Fig. 1 clearly illustrates an example of "correct" and "incorrect" uses of 250 V rating equipment on a switchboard assembly. The small right-hand unit on the bottom of the panel has its outgoing circuit wiring (in this case m.i.c.c. cable) taken separately to its termination point, whilst the left-hand small unit on the bottom of the panel shows the outgoing circuit wiring taken back into the trunking or busbar chamber where it is housed together with wiring from a different phase. In this case the left-hand unit should have been of 500 V rating or, alternatively, the outgoing circuit wiring taken separately as for the right-hand unit.

Reg. 302—Current rating of apparatus. Sub-clause (A) of this Regulation is very clearly worded and there is little difficulty in normally observing its requirements, taking into consideration the diversity factor that may be applied in accordance with the requirements of Reg. 111 and the notes attached thereto.

It is, however, worth while drawing attention to the increasing use of the larger type domestic cooker with its higher connected loading. It is not always appropriate to connect these to a 30 amp cooker control unit, particularly one incorporating a socket-outlet for the connection of an electric kettle.

The requirements of sub-clause (B) cannot too strongly be impressed on the student's mind, as it is essential that all fuses and circuit-breakers afford the proper protection to the outgoing circuit wiring. There must therefore be a permanent indication of the current rating of each circuit, together with its appropriate fuse element or cartridge or circuit-breaker setting. Circuit identification charts are usually provided with the equipment, and they should be used unless other permanent circuit identification lists are provided by the contractor and attached to the equipment.

Reg. 303—Selection of apparatus for situation. There is a wide range of accessories, apparatus and equipment manufactured for use under different operating conditions. It is important to ensure that the appropriate types are used on an installation, taking into account the situation in which they are required to function. This often applies to agricultural and farm installations.

Fig. 2 shows a very bad example of cleat wiring, wooden fuseboards and obsolete pattern switch and fuse gear used for an industrial installation where mechanical protection of the wiring and earth continuity are of the utmost importance.

Mention should also be made of the need to fit protective skirts to lampholders where they are installed within reach of earthed metal, e.g., a pendant or batten-holder positioned over a cooker, sink or bath with which a person may come into contact when removing or replacing the lamp. The protective skirt should be of the correct type, designed to shield the whole of the lamp cap.

Reg. 304—Damp situations. Although this regulation is clear in its requirements for appropriate type equipment to be used in such situations, it is of equal importance to make sure that all the accessories, apparatus and equipment used, together with conduit connections and glands attached thereto, are properly protected against corrosion.

Reg. 306—Inflammable or explosive conditions. The use of properly designed flameproof enclosures or intrinsically safe apparatus in inflammable or explosive conditions is clearly defined in sub-clauses (A) and (B) of this regulation, but of equal importance, of course, is the need to install

* Mr Sutton is Chief Technical Officer, National Inspection Council for Electrical Installation Contracting. His previous article in this series, "Eliminating Installation Faults by Instruction," was published in the ELECTRICAL TIMES on 11 February, p. 201, and 18 February, p. 263.

the wiring, accessories, outlet boxes and all connections thereto to the same standard.

Clause (D) of this Regulation requires that every fixed item of apparatus, unless of a totally enclosed or flameproof type, must be fixed at a height of not less than four feet above general floor level. It is not uncommon to find ordinary industrial-type switches, socket-outlets and lighting fittings mounted below this level, particularly in inspection pits of garages, where it is possible for petrol vapour to collect.

Reference should also be made to the "Model code of principles of construction and licensing conditions" for petrol filling stations, basement garages and underground car parks, published by H.M. Stationery Office (Crown copyright reserved). The relevant electrical requirements for petrol pumps have been extracted and, as they are of particular importance, are quoted in full.

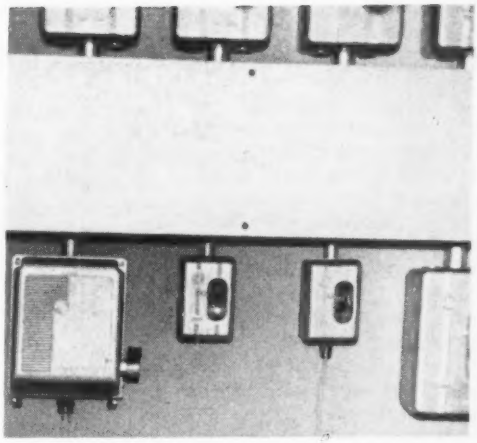


Fig. 1 (above). Example of contravention of Regulation 301B. The left-hand small switch fuse arrangement should be of higher voltage rating

Fig. 2 (right). Bad example of cleat wiring in an unsuitable (industrial) installation, contravening Regulation 303

Reg. 312—Socket-outlets, plugs and connectors. Reference is made in this regulation to the proper selection of these accessories in accordance with the requirements of Reg. 609 and clear instructions are given as to the method of connecting three-pin plugs and sockets.

By far the majority of new domestic electrical installations are provided with 13 amp three-pin socket-outlets to BS 1363,

Model Code Requirements for Petrol Pumps

Pump Motors. The enclosures of pump motors should be of flameproof construction.

Switchgear. The casings of all switches, contactors or relays situated within or on the pump equipment housing, whether used for power, lighting or other purposes, should be of flameproof construction.

Lighting Fittings. Lighting fittings situated within, or partly within, the pump equipment housing should be of flameproof construction. Lighting fittings mounted on the outside of the pump equipment housing should be of an enclosed design in which the lamp is protected by a well glass or other glass sealed to the body of the fitting by a gasket so as to prevent the ingress of petroleum spirit vapour into the fitting.

Wiring. All cables within the pump equipment housing should be enclosed in heavy gauge galvanised solid-drawn steel conduit. The ends of the conduit should be screwed into the flameproof apparatus and into conduit fittings where the latter are used, so as to engage the threads by the length specified in BS 229; the joints should be treated against ingress of water. Alternatively, (i) mineral-insulated copper-sheathed cable with appropriate flameproof fittings may be used, or (ii) cables with a continuous metallic sheath protected by steel wire or steel tape armouring, the apparatus being provided with wiping glands for the metal sheath and with armour clamps. Where the type of cable is such as to require sealing of the insulation, appropriate sealing boxes should be used.

Conduit Fittings. All conduit fittings within the pump equipment housing, such as inspection bends and joint boxes, should be of flameproof construction and galvanised.

Connections of Supply Cables. Connection of the electricity supply should be made to the flameproof part of the installation within the pump equipment housing by means of wiring enclosed in heavy-gauge galvanised solid-drawn screwed steel conduit, the end of which within the housing should engage the termination provided by the pump manufacturer by the length specified in BS 229. The conduit should preferably be in an unbroken length within the base of the pump, but if conduit fittings are necessary because of the nature of the conduit run, they should be of flameproof type (see "conduit fittings" above). Joints should be treated against the ingress of water. Alternatively cables as in "wiring" (i) or (ii) above may be used. Conduit or cable sheaths should not be used as one of the conductors supplying the apparatus, i.e., all conductors of the supply wiring should be insulated.

Earthing. The metal enclosures of all apparatus and the conduit should be efficiently earthed.

*Electrical Protection.** The supply circuits of each pump should be separately protected by fuses or circuit-breakers set to operate at a current value as near as practicable to the normal current taken by the apparatus. The fuses or circuit-breakers should not be situated within or on the pump equipment housing.

A master switch inaccessible to the public should be provided in a suitable position.

The power connections† to the pumps should be to the satisfaction of the licensing authority.

The term "flameproof" applied to the electrical apparatus means (a) apparatus which is certified to Group II standard by the Testing Authority (the Ministry of Power) in accordance with BS 229 and BS 889, as appropriate, and which is marked with the Flameproof Certificate Number: or (b) apparatus which has been approved by the Underwriters Laboratories Incorporated, USA, for Class I, Group D hazardous locations and which is labelled accordingly.

* It would appear in practice that the requirements for electrical protection may be misunderstood. Briefly, what is required is that each pump must be self-contained and separate as regards its electrical wiring. It is permissible to loop the lighting on the pump from the motor final sub-circuit so that the motor and pump are controlled by one set of fuses. It is preferable, however, that separate final sub-circuits shall be taken to the light and the motor within each individual pump.

† Attention is drawn to the statement that the power connections to the pump should be to the satisfaction of the licensing authority. It has been found in practice that local authorities sometimes vary in their actual requirements as to the methods of control of the installation and to the positioning of the control equipment. It is advisable at all times to check up with the local licensing authority to find out their actual detailed requirements for any particular site.

but there are many existing installations that are utilising socket-outlets to BS 546, frequently with a mixture of 2 amp, 5 amp and 15 amp outlets in the same installation. It cannot be too strongly urged that, where extensions are required to an existing installation, the existing types of outlets shall be used, unless it is possible to justify the changeover to the standard type 13 amp socket-outlet. The introduction of different types of socket outlet to an existing installation only encourages the use of undesirable adaptors and other "hook-ups" which may be a source of danger from fire and shock.

Reg. 313—Portable appliances. The provision of an adequate number of socket-outlets in an installation, for the connection of portable appliances, is one of extreme importance and is fortunately receiving the publicity that is so necessary. With the use of the ring circuit (see Reg. 114), it is relatively easy to supply sufficient outlets and to add additional ones without a major alteration to the system.

Reg. 314—Non-portable appliances. This regulation covers the requirements for taking connections to, and controlling, non-portable appliances. The latter term includes such fixed items as wall-mounted fires or heaters, water heaters (including immersion heaters), floor-warming circuits, etc., and also free-standing appliances such as block storage heaters, washing machines, refrigerators, etc.; it also includes electric clocks and bell transformers where these are not each fed from a separate final sub-circuit.

When the control switch or control unit is mounted apart from the appliance, then it may be of the single-pole type, provided (where it is a heating appliance) the heating elements are so screened that they cannot be touched.

Where the switch or control unit is mounted on the appliance, then any part which remains alive when the switch is in the "off" position must be screened or so protected, as to prevent any accidental contact with it, whilst carrying out maintenance work.

In domestic premises the control switches must be installed in the same room as the appliance, except where floor-warming circuits are concerned, where they may be located at the control unit position. This latter point has recently been accepted in the eighth issue of the IEE Abstracts of Interpretations of the 13th Edition.

It is, of course, essential to ensure that any switches or control units positioned within a bathroom are out of reach of a person in contact with the bath, and this usually requires the provision of a pull cord switch. This type of switch may now be obtained in the double-pole pattern complete with neon pilot light, and it is advisable to use this type so that some visual warning is given that the appliance is switched on.

Reg. 315—Control of motors. Most of the requirements of this regulation are well known and are fully observed, with the possible exception of Sub-clause (B) (ii). Unless the means of isolation of the motor and control gear is located immediately adjacent to the motor, then an additional means of isolation must be provided immediately adjacent to the motor, unless the primary isolator can be locked in the "off" position. The secondary isolation may be either by an isolating switch or it may be effected by removable fuses or links.

Attention is also drawn to the necessity for providing separate means of manual isolation mounted on or immediately adjacent to any machine supplied from overhead busbars or other multi-tap feeder.

Reg. 316—Motor circuits. When studying this regulation, the student is advised also to take into account the recommendations for good practice contained in the Code of Practice CF 321.102—"Installation and maintenance of electrical machines, transformers, rectifiers, capacitors and associated equipment."

With the relatively heavy starting currents taken by some motor equipment, it is necessary to take this into account when calculating the sizes of the cables feeding the motor.

Although excess current trips may be provided on the motor control gear, it is nevertheless essential to install the correct rating of fuse element to give proper protection to the cables supplying the motor, taking into account the operating characteristics of the type of fuse used, viz., whether cartridge or wire element.

Reg. 318—Use of auto-transformers. The conditions under which auto-transformers may be used are clearly indicated in this Regulation. However, there has recently been issued in the eighth Abstract of Interpretations of the 13th Edition a qualification with respect to the application of sub-clause (B).

A unit incorporating an auto-transformer supplying integral socket-outlets, connected to the primary mains voltage and giving a step-down voltage of 110 volts, may be used for the purpose of connecting an electric dry-shaver in bedrooms or cloakrooms and elsewhere except in rooms containing a fixed bath, where the requirements of Regulation 405 must be strictly observed.

Reg. 323—Single-phase electrode water heaters and boilers. Until recently this Regulation has been considered as the appropriate one to cover the requirements for the installation of instantaneous type water heater, where the heating element is in direct contact with the water supply.

It has become apparent, however, that certain types of equipment were being produced having the outside shell or container manufactured of insulating material and not of metal. This necessitates some reconsideration with respect to the requirements for the installation of such equipment, but since these have not yet been finalised, the present requirements of Regulation 323 should apply for the time being, if the installation is to be certified as complying with the requirements of the current edition of the IEE Wiring Regulations.

It is hoped that later articles will extend consideration to other parts of the Regulations.

Standard Hydro Units

DESIGNED specially to provide a simple and reliable source of a.c. power in remote areas, a range of small standard hydro-electric generators has been developed by Gilbert Gilkes and Gordon Ltd., of Kendal. The ratings covered are from 5 to 25 kW, and the machines involved are suitable for operation for hydraulic heads between 90 and 300 ft. A prototype unit has been sent to Peru.

The design consists of a Gilkes Turgo impulse wheel overhung on the lower shaft extension of a vertical-shaft alternator. Water is supplied to the turbine through a spear regulator of normal design, which obviates the need for an inlet valve if the pipeline is short. Speed control is by means of a jet deflector operated by a shaft governor mounted on top of the alternator.

A feature of the unit is that it is governed to generate at standard voltage and frequency, so that it can be used with normal domestic or agricultural equipment. The alternator is of the well-known Stamford design, with a simple static excitation and regulation system housed in the control panel. The units are designed for tropical conditions and for altitudes up to 10,000 ft.

Technical co-operation in European supply

LOAD-FREQUENCY CHARACTERISTICS OF NATIONAL SYSTEMS

EIGHT European countries co-operate closely to obtain greater efficiency in electricity generation through interchange of power over an interconnected transmission system largely operating at 220 kV. These countries are Austria, Belgium, the Federal Republic of Germany, France, Italy, Luxembourg, the Netherlands and Switzerland. An outline of this organisation and of the magnitude of operations was given in the ELECTRICAL TIMES last year (29 October, p. 459); now we are able, through the courtesy of Mr L. Wolf, President of the Union for Co-ordination of Generation and Transmission of Electricity (UCPTE), to say something more of the technical activities of the organisation. The source on which the following notes are based is the annual report for 1958-59 of UCPTE.

Power Exchange Policy

One of the most interesting projects in hand is a study of the system load-sharing characteristics of the European networks. The UCPTE has, as a matter of policy, avoided recommending erection of a transmission system superimposed on the existing systems (largely 220 kV) of member countries. The feeling was that interchange of power, largely concerned with ironing out differences in daily and seasonal curves, would be better carried out by trans-frontier connecting lines at appropriate voltages.

With this decision taken, the task of co-ordination resolved itself at technical level into adoption of a uniform pattern of load-frequency control, uniform designation and balancing of phases of the various three-phase systems, and standardisation of measurement practice and the like. Work to this end has been in hand since the formation of UCPTE in 1952, and it has been backed by "liberalisation" of the payments practice for power transfers between countries.

The degree of success achieved in this work is underlined by the claim in the report that with the systems of almost all the UCPTE countries operating in parallel day and night, it is possible to provide emergency transfers of power from one country to another within a few minutes of a request being received.

The factor in such exchanges already mentioned, the load-sharing characteristics of the various systems, has been under investigation by one of the Union's working parties for some time. In any one system, the turbine governors are set to keep system frequency within a pre-set band of variation, despite varying load, without causing a substantial change in load allocation between the various machines connected. The usual parameter used in discussing these factors in load-sharing is load-frequency characteristic, sometimes called "bias," which is the ratio of load change to the frequency caused by that load change, and is expressed in megawatts per cycle per second. A related parameter is "droop," which is the same ratio, but with frequency change expressed as a fraction of rated frequency and load change expressed as a fraction of rated load.

Frequency-load Tests

To determine the frequency-load characteristics of the interconnected systems, UCPTE members have carried out a number of tests in which a known load has been shed, for example, by opening an interconnector, and the resultant frequency change observed. Values obtained range widely, and are shown in Table 1. Experience with tests of this nature has shown that it is far from easy to obtain fully repeatable results, because system load conditions are changing while the tests are in progress. A further difficulty arises from the different control arrangements existing with hydro and thermal generating stations. For example, run-of-river hydro plants account for a greater proportion of the supply during the night than during the day; and such plants are often fitted with opening limiters. The result is different frequency-load characteristics during the day from the night.

As a result of the tests, and earlier experiments of this nature, the UCPTE has drawn up a number of recommendations for consideration by members. These are as follows:

Elimination of the load limiter on hydro turbines, with introduction of an auxiliary control system permitting the turbine governor to respond to frequency variation, but restoring the turbine opening to the programmed value after a pre-set time. Such a system is already installed in four stations of Bayernwerk AG, a German supply authority.

Cutting-out the dashpot on hydro turbine governors immediately after the generator has been switched on to the line.

Table 1. Results of Tests to Determine Frequency-Load Characteristics

System (see below)		1	2	3	4	5	6	7
Total system output (a)-MW	min	2,150	1,200	2,450	1,250	1,100	1,600	1,950
	max	2,200	1,700	3,250	1,550		3,300	2,536
Power cut-off (b)-MW	min	32	10	27	8	14·5	25	25
	max	100	90	102	32·4	50	214	109
(b) as % of (a)	min	1·5	0·6	0·8	0·6	1·3	1·0	1·2
	max	4·5	5·3	3·1	2·6	4·5	6·5	4·3
System bias (MW/c/s)	min	400	167	316	83	110	120	420
	max	530	470	635	161	273	350	800
System droop (%)	min	8·1	7·2	10·2	19·3	8·0	15·0	6·0
	max	11·0	20·4	15·7	30·0	20·0	20·0	9·1

1. Belgium; 2. F.R. Germany Bayernwerk; 3. F.R. Germany Bayernwerk + Austria Verbundges; 4. Austria Verbundges; 5. Italy SIP; 6. Italy Edison Group; 7. Netherland SEP

Table 2. Maximum loads exchanged on at least four days within a fortnightly reporting period (in MW)

Countries involved	1955	1956	1957	1958
France–Belgium	95	85	85	90
France–Luxembourg ...	10	10	10	10
France–F.R. Germany ...	115	155	125	155
France–Switzerland ...	290	335	270	370
France–Italy	70	80	135	140
Belgium–Netherlands ...	75	80	140	140
Belgium–Luxembourg ...	20	25	25	25
F.R. Germany–Netherlands	165	210	220	185
F.R. Germany–Belgium ...	85	140	160	190
F.R. Germany–Switzerland	260	275	470	635
F.R. Germany–Austria ...	660	745	720	830
Italy–Switzerland ...	100	90	140	110
Italy–Austria	20	100	130	90
Total	1,965	2,330	2,630	2,980
Transmission capacity of international tie lines—total (MW)	3,901	4,367	5,122	5,922
Utilisation coefficient (%)	50·5	53·5	51·5	50·3

Increase of governor sensitivity, possibly by using electrically controlled turbine governors.

Use of electrical regulators in steam stations, permitting combined control of turbine and boiler, so freeing control from the delaying effects of admission pressure control, and so increasing sensitivity.

Provision of controllers operating on the principle of combined frequency-load control for industrial power stations feeding into public supply networks, so that these can contribute to frequency maintenance.

It is of interest to compare the results obtained with those for the British grid system, which were discussed in an IEE paper published last year. For sudden changes as in cut-off tests, the figure was given as between 2,000 MW/sec and 5,500 MW/sec, according to the connected plant and load conditions prevailing at any one time, with mean drop about 5%.

Other Technical Investigations

The work of UCPTE on frequency-load characteristics has been described at some length, but it is only one of several technical investigations currently in hand by the Union. Another inquiry has been concerned with the minimum and maximum voltages occurring at the interconnecting points between systems. It has been found that the voltage levels of adjacent networks are not yet an obstacle to parallel operation, but that they are likely to be an increasingly important factor in the future. Other subjects of interest are characteristics of direct neutral earthing, results of parallel and ring operation, the rate of load variations at certain times of the day, and the influence of the five-day working week on power consumption. There is also machinery for an extensive exchange of experience on operating incidents.

Finally, from the extensive account of the Union's activities noted in the report, mention may be made of a code of practice for precautions to be taken when starting up a new steam station. This is a set of detailed recommendations for plant engineers on preparing each section of the equipment for commissioning, to prevent trouble during the early days of operation.

Magnitude of Interchange

UCPTE does not regard itself as a statistics-collecting body, but the annual report does include a discussion of the extent of interchange between its members, and some of the figures presented are noted in Table 2.

Underground Oil-filled Transformers

AS an alternative to buried dry-type, natural-air-cooled Class "C" insulated distribution transformers, which are being increasingly used as a convenient method of reinforcing existing electricity supply networks, Ferranti Ltd. have introduced buried oil-filled units utilising conventional Class A insulating materials. Possibilities of such oil-filled buried transformers have already been recognised. Recently a 750 kVA, 6·6 kV/433V 3-phase, 50 c/s unit was commissioned by the North Western Electricity Board in Manchester, and has been operating successfully under distribution system load conditions. Prior to installation, the unit was tested to the requirements of BS 171:1959 under simulated operating conditions in the Ferranti works at West Gorton.

The buried oil-filled Class A insulated transformer, less expensive than the buried dry Class C insulated transformer, offers similar advantages. It can be buried at a load centre without difficulty, avoiding any need to acquire new sub-station sites, which may not be readily available near the centre. Core and windings of the transformer are contained in a strongly protected tank which can be buried directly in the ground, in intimate contact with the soil, under a pavement or grass verge, for example, with only a comparatively small ventilating pillar showing above the surface. Such an arrangement eliminates to a great extent the problem of enclosures associated with conventional above-ground oil-filled transformers.

The above-ground cooling arrangement of the new oil-filled buried transformer, comprising radiator and protective housing, is designed on the lines of a conventional distribution pillar. As it is offset to one side of the tank, the core and coils can be removed without difficulty should this be required during the lifetime of the transformer. This has the additional advantage that the pillar can be installed in a wall or hedge whilst the main tank is buried beneath ground. The only visible part of the unit can, therefore, be made to blend unobtrusively into its surroundings. Careful design has also ensured that the pillar is fully weatherproof, whilst allowing free ventilation. Arrangements have been made for sampling and filtering of oil to be carried out from above ground, and tamper proof access to the oil level indicator, silica gel dehydrating breather and thermometer pocket is provided.

Production of buried oil-filled units can be undertaken throughout the distribution transformer range. Units can be supplied with or without tapping links, access being gained where necessary by means of a manhole cover.

Supply in Queensland and Victoria

7–9% LOAD GROWTH IN AUSTRALIAN STATES

GROWTH in electricity demand in the two Australian States of Queensland and Victoria was maintained during the year ended 30 June, 1959, as shown in the annual reports of the State Electricity Commissions. In Queensland, over £A11 million was expended on development, bringing the total capital investment in electricity supply to nearly £A129 million. Fixed assets of the Victoria Electricity Commission rose by 8·1% during the year to nearly £A246 million, and the report shows a profit of £A423,319. The table below gives some details of generation and transmission in the two states.

Victoria

The State Electricity Commission's income rose during the year by 13·4%, partly due to an 8% rise in charges introduced in late 1958, but also to a sales increase of nearly 338 million units, or 8·1%. A 12% reduction in fuel costs, largely responsible for decreasing operating expenditure by nearly £900,000, is attributed primarily to the latest generating plants at Yallourn-Morwell.

The first three turbo-alternators, each rated 80 MW, were brought into service at Morwell during the year and work is proceeding on the new 240 MW station at Yallourn. This station is scheduled for commissioning in 1961-62 and forms part of an extension programme totalling 363 MW. This includes a third stage at Morwell and two hydro-electric stations: the Kiewa and Cairn Curran schemes totalling 98 MW, which should be completed this year.

The Hazelwood generating project, on which preliminary survey work has started, will have an ultimate capacity of 1,200 MW provided by six 200 MW turbo alternators. This station will be one of the first to operate on the interconnector with New South Wales, inaugurated when the 330 kV line linking the state system at Dederang to the Snowy Mountain Scheme came into service last year. Although the completion of this link is perhaps the most significant feature of recent transmission developments, considerable lengths of 220 kV lines have also been installed during the year and a helicopter service is in operation for patrolling these lines, emergency work, and for conducting aerial surveys. In March, 1959, the main control centre for the state at Richmond was placed in service.

Coal production forms an important part of the Electricity Commission's activities with sales totalling nearly £A2·9 million. Some 11½ million tons of open cast brown coal were mined during the year, and a large proportion of this was used in Yallourn station, while 2½ million tons were formed into briquettes for sale.

Electrification of the State is now reckoned to be entering the final stage, for only 50,000 of the 770,000 dwellings have yet to be connected. Supplies to farms have increased nearly ten-fold since 1939, largely due to success of the "self help" plan initiated by the Commission.

As in this country, safety of the public is a constant concern of the Commission, and Press, radio and television campaigns are used in an attempt to reduce the number of accidents. Last year 19 fatalities occurred, and most of these resulted from lack of maintenance of flexible cords on consumers' installations.

Good news for the consumer is that from January 1961, unrestricted connection of electric storage water services will be permitted, but tramways in two of the towns are under a distinct cloud for it has been revealed that although average fares are just under 4d per journey, the cost of services averages 11½d.

Electricity supply in Queensland and Victoria for the year ending 30th June, 1959

	Queensland	Victoria
Expenditure on development during 1958/59 million £A ...	11·4	26·1
Average revenue per unit d ...	2·75	2·43
Units generated millions kWh ...	1,913	5,534
Installed capacity MW ...	646	1,305
New plant commissioned during 1958/59 MW ...	113	160
New h.t. lines miles ...	1,600	1,795
Number of consumers thousands ...	384	650
New consumers in 1958/59 thousands ...	20	30

Queensland

Future developments are very much in the minds of Queensland electricity authorities, and during the year they appointed Messrs Merz and McLellan to carry out a comprehensive survey and to make recommendations for future expansion. The survey is nearing completion and is based on forecast demands in Queensland ranging from 484 MW this year to 2,089 MW in 1980. It seems that generation will be based on coal for some time to come.

Load growth was centred around Brisbane and the Southern Electric Authority where the rate was about 7% p.a. In this area 60 MW of additional generating capacity was brought into service, bringing the total installed capacity to 415 MW. The five regional boards increased their total capacity by 51 MW. New schemes under construction include the Barron River hydro-electric station, estimated to cost nearly £A6 million. The project is scheduled for completion in 1963.

A topical note in the report refers to investigations in progress on grit emission from power station chimneys. Accidents are also causing concern in the State, and although a free inspection service is available for household wiring and appliances, amateur workmanship is blamed for the majority of accidents.

Space is apparently not as wide-open in Australia as we are led to believe, for in Brisbane, over 2,000 parking meters are in use which are maintained and patrolled daily by the Commission, while in Rockhampton City, substations are being constructed in structures straddling the roads. This unorthodox siting overcomes lack of space and flooding difficulties. Reason for the demand is a rapid increase in the use of large air-conditioning units.

NOTES ON WIRING

BY MEGOHM

WITH the Electrical Engineers' Exhibition in full swing, I make no apologies for returning to the subject of ring circuits, and, in particular, to the vexing problem of adding extra socket-outlets to the completed circuit. One manufacturer exhibiting at Earls Court has sent me details of a conversion unit which is going to be of considerable assistance in this matter, although it does not provide the complete answer. The unit consists of a two-gang pattress, with a metal plate for earth continuity, which can be fitted on to any type of installed flush 13 amp socket box. A twin-gang socket-outlet is then fixed to the pattress, which is available in cream or brown to match their range of sockets.

From a preliminary examination of the arrangement shown in the manufacturer's catalogue, I consider the unit is really excellent and I intend to use it in my own home. I particularly admire the simple, yet ingenious method for obtaining earth continuity between the box and the unit. Visitors to the exhibition will do well to examine this accessory.

More Plug Trouble

I had an interesting letter from an electrical engineer commenting on my remarks on the working loose of 13 amp plugs from their sockets. My correspondent has had experience of some sockets installed in a large private house as outlets for portable electric heaters of 1·5 and 2 kW rating controlled by wall-mounted thermostats.

Two fires had occurred at socket-outlets and the first impressions were that the plugs had not been fully pushed home, but after some investigation it was realised that this was not so and, in fact, the cause of the trouble was the plugs having become loose in their sockets as a result of moving furniture about, using vacuum cleaners and even treading on the flexible. When current passed in response to the thermostat, overheating and subsequent arcing took place at the ends of the pins.

I realise that this may, in some people's opinion, be an exceptional case, but I would remind them that a refrigerator or an immersion heater served from a 13 amp socket-outlet could present an identical situation. In many such cases, the plug may not be looked at for months on end and a fire could originate there if the plug did loosen.

Housing Standards

I have followed the Government-sponsored investigations into housing standards with interest and although I have found it difficult to ascertain any early conformity in proposals on houses generally, I note, from two reports in the ELECTRICAL TIMES (7 Jan., 18 Feb., 1960), that various sections of the electrical industry are presenting reasonably similar and well-thought-out cases for improving domestic electrical installations and provision for appliances. The first report detailed the IEE proposals, the second the EDA case.

Without referring directly to these reports, but using the same questionnaire, I should like to present my own views. Assuming that the house is built to my ideas of "standards" (with windows and doors which open and close satisfactorily, skirtings and architraves which are not splitting and falling off and floors which are level and properly laid), the electrical installation should first be of the best material possible (bearing in mind the price range of the house) and installed by a contractor who is not afraid to leave his name, address and telephone number clearly displayed at the intake position.

Lighting is particularly important, and I should like to see even the smallest cupboard fitted with a lamp, and also the outside of the entrance doors illuminated in order to cut out this "blind-man's-buff" approach to inserting the key in the lock after dark. The back door is as important as the front, since the lady of the house regards this as the correct place for tradesmen to call, and it is surprising how many of them call after dusk.

I should also like to see more use being made of two-way and intermediate switching, not only in halls and on staircases, but also in kitchens and living rooms which have two or more doors. Ceiling pull switches have always annoyed me, although I entirely agree with the principle governing their use. Whilst on this subject, and on the rooms affected by them, we must face up to the fact that electric shavers are becoming extremely popular but are not encouraged in the bedroom. They should, in my opinion, be used in the bathroom, where shaving, whether dry or wet, forms an inescapable part of normal ablutions. We must, therefore, think up some comprehensive ideas for installations in bathrooms.

Flat-dwellers' Problems

In considering flats and maisonnettes, a request is made for experience on refuse disposal, coupled with mention of the "individual sink destructor." I, personally, am all in favour of these units, if only for promoting hygiene, and I feel they could well become standard, particularly for flats.

Another problem particularly affecting flat dwellers is the provision for home laundering. It is a difficult question, because I feel that this activity is definitely a part of indoor home life and not a communal, or outdoor, business, with the possible exception of clothes drying. People try to convince me that a spin dryer is the ideal, but personally, I say there is nothing finer than fresh air for drying clothes and making them feel fresh. Obviously in multi-storey buildings it is difficult to provide space for natural drying and therefore artificial means must be provided. It is a matter on which manufacturers of drying and airing appliances could well be invited to give their views, and also get their "boffins" to work in conjunction with architects.

Safety considerations and adequacy are the two other questions which remain to be answered, and I think I have said ample about these matters in the past. As far as safety is concerned, education in the use of the installation and apparatus is one answer, with abolition of the "do-it-yourself wireman" close behind it. As for adequacy —by the time the collation of ideas by the powers that be has been published, the ideas themselves will be out of date and, anyway, the people who will eventually force this issue, I am sure, will be the women of this country.

Remote fault alarms

FURTHER DEVELOPMENTS FOR SUBSTATIONS

by E. N. MacQueen,* A.C.G.I., A.M.I.E.E.

IN the ELECTRICAL TIMES of 7 February, 1957, a description was given of a system introduced by the Eastern Electricity Board for transmitting alarms from unattended substations to a central control point, making use of the existing telephone installed in the substation.

This system has proved of immense value in affording early warning of fault conditions which previously were made known only by the receipt of telephone calls from consumers without supply. By means of this alarm the control engineer is advised of the location of the substation at which the fault has occurred, but no information is available regarding the precise nature of the fault. In many cases, particularly where large rural overhead systems are concerned, this information is sufficient since the duty engineer has to visit the substation in any case.

In the larger and more important substations, however, more detailed information regarding the fault could enable the control engineer to decide on the most appropriate action to take to ensure the restoration of supply with the minimum of delay.

It is now possible to achieve this by again making use of the telephone installed at the substation, and the Eastern Electricity Board have recently installed two such systems at 33 kV substations in their Fens Sub-Area. This equipment, known as the Datofonic Supervisory System Mk.I, like the earlier pattern, makes use of a recorded message technique at the substation. The conditions of all items connected to the alarm are described on the record and up to twenty component pieces can be accommodated, included circuit-breakers, transformer tap positions or miscellaneous alarm conditions. A selector switch in the alarm circuit "scans" each item in turn and transmits the appropriate portions of the recorded message.

General view of the Datofonic installation in a 33 kV substation

When a fault occurs the alarm circuit is energised and initiates a call through the telephone exchange by means of the recorded message. This identifies itself by name and telephone number and proceeds to describe the condition of all equipment at the substation connected to the alarm system.

Repeat Message Provision

Should there be delay in the control engineer answering the call and part of the recording is missed, provision is made for the engineer to request a repeat message. This is effected by the engineer pressing a small switch, which transmits a tone back to the substation. He is advised of the appropriate time to send this signal by a message from the record saying, "Send Repeat Signal Now."

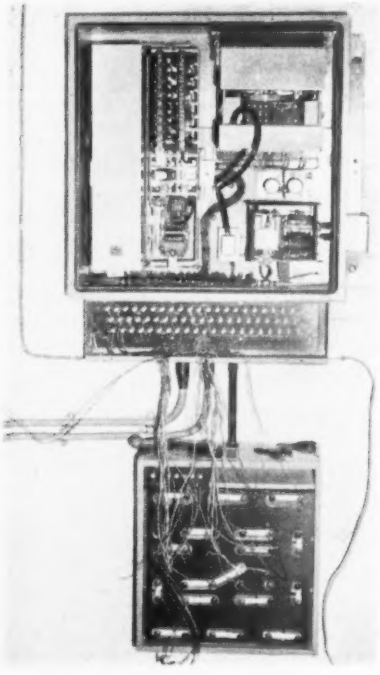
As in the case of the equipment described in the previous article, the Datofonic installation is arranged to transmit a number of calls at predetermined intervals to cover conditions where the control engineer's line may be engaged at the first attempt. If, however, the first call is successful then the control engineer can cancel further calls by transmitting a tone when requested by the record to "Send Acknowledgement Signal Now."

A further valuable feature of the Datofonic system is that the condition at the substation can be ascertained at any time by making a telephone call from any telephone connected to the system.

The Datofonic equipment makes use of standard telephone type components mounted on conventional jack-in relay set bases and is assembled in a metal cabinet which is virtually airtight. Connections from the auxiliary contacts of the switchgear, etc., are marshalled on a terminal assembly at the base of the alarm unit.

Power supply is normally provided by large capacity dry cells which should last up to 12 months depending on the number of operations over the period. In the event of the battery volts falling below a predetermined figure, a recorded message states, "Battery Volts Low—Please Report."

The illustrations show the Datofonic apparatus in course of erection with the cables from the auxiliary contacts of the substation switchgear being connected to the terminal strip of the Datofonic installation. The batteries are housed in the metal cabinet mounted beneath the alarm unit enclosure.



The Datofonic Supervisory system unit and terminal board during erection and the battery box below

* Mr MacQueen is with the Eastern Electricity Board.

OVERSEAS NEWS

from our correspondents abroad

CANADA

More Stations for Ontario

A further hydro-electric development in the James Bay Watershed, estimated to cost $182 million, is announced by the Hydro-Electric Power Commission of Ontario. It includes construction of three power stations with an ultimate capacity of 350 MW, and some 450 miles of e.h.v. transmission line to feed the output to the hydro's combined north-eastern and southern Ontario systems. The new stations will be located along a 15-mile stretch of the Mattagami River between Kapuskasing and Moosonee. Work will start this spring on the southernmost plant, at Little Long Rapids, about 40 miles north of Kapuskasing. It is scheduled for completion by the winter of 1963 with a tentative initial capacity of 114 MW. By the winter of 1965, a second station downriver at Upper Long Rapids is scheduled for initial operation with a capacity of 110 MW. The third plant will be still farther downstream towards James Bay at Lower Long Rapids. Preliminary plans call for a 132 MW of plant operating by the winter of 1966. Some 30 miles east, the Commission is already building a station at Otter Rapids on the Abitibi River which will be placed in service next year. These four stations in the Moose River system will have a total capacity of 528 MW by 1966. They will be expanded later in a long-range programme to utilise north-eastern Ontario rivers which could yield out 1,500 MW over the next 20 years. To increase the flow of water to the four stations, two river diversions are proposed: the Little Abitibi River will be routed into the Abitibi, and the Opasatika River into the Mattagami. A third diversion will permit excess water to bypass the station sites during flooding periods.

Peace River's First Step

The massive Peace River power project, B.C., passed the first of three necessary tests when Mr A. F. Paget, the provincial comptroller of water rights, announced a few days ago that he found the plan entirely feasible from an engineering standpoint. The company is now expected to apply to the Public Utilities Commission for a certificate of public convenience and necessity. The third step required is the application to the comptroller of water rights for a water licence. In his announcement, Mr Paget stated that the energy generated under the company's proposals could be marketed in British Columbia within the times expressed provided no other major resource development, either hydro or thermal, absorbs part of the market. He recommended that the Provincial Government undertake a study of an overall provincial power grid before the practicability of the proposed transmission system is determined. The company proposes to build a 400 mile transmission line from the Peace River to Lillooet, with the B.C. Electric Co. providing transmission lines from there to Vancouver.

Ready for Licensing

The framework for a plan to examine and licence all electricians operating in Ontario was approved by the Electrical Contractors' Association, of Ontario, following their annual conference, held at Hamilton, Ontario, last month. Mr J. K. Legault, president, announced that the machinery for controlling the standards of all electrical installations was now ready if the Provincial Government wanted it. It is the association's view that the public has the right to know that men doing electrical work have the necessary qualifications. The association, apparently, hopes to hear soon that the provincial cabinet favours legislation for licensing of electricians.

U.S.A.

Tenders Soon

It is anticipated that the US Army Corps of Engineers will soon be seeking tenders for the supply of generators for the McGee dam hydro-electric scheme, in Texas. The scheme has been under consideration for some years and civil construction work started a short while ago. It involves the building of a dam across the Angelina River, about 45 miles south east of Lufkin, which will form a lake some 40 miles long.

NORWAY

Project Completed

The second and final 75 MW generating set at Upper Vinstra power station was recently commissioned, marking the completion of the Vinstra hydro-electric power development, in East Norway, which was begun 14 years ago. The Lower Vinstra station, with four generators, was completed in 1958. Total capacity of the two stations is 320 MW. Oslo Municipal Power Co. owns two-thirds of Lower Vinstra and one-fourth of the Upper Vinstra project.

AFRICA

Supply Received

Due back in Britain within the next few days is Sir John Hacking, partner in Merz and McLellan. Along with Mr J. S. Clinton, former city electrical engineer of Salisbury, he has been undertaking a review of the electricity supply position throughout Rhodesia at the request of the Federal Ministry of Power. Their terms of reference are: "To consider, in the light of the commissioning of the Kariba project, the legislative framework and organisational structure of the rest of the electricity supply industry in the Federation, and to make recommendations for such revisions as would best serve the future needs of the Federation."

H-E Plan Adopted

Taking another major step towards multi-purpose river development, the Nigerian Federal Government have adopted the proposals for dams on the Niger and Kaduna rivers. In addition to providing electric power, the proposals provide for irrigation, flood control and navigational improvements. Of four possible schemes which were earlier considered, the Government favours the Kurwasa/Shiroro project under which a dam would be built on the Niger River some 60 miles upstream from Jebba. This would create a reservoir to support a fishing industry and provide water for a hydro-electric plant. This stage of the scheme is estimated to cost £55 million, and would provide electricity which could be transmitted to Kano and Lagos and all areas between those two places. When the output from the first plant is fully exploited, the second dam would be built at Shiroro, on the Kaduna River. In the view of the experts, the dams are both complementary and supplementary; one without the other would not solve all the problems involved. They also consider that the project does not depend for its economic viability upon the development of any particular industrial project but, upon conservative estimates of the growth in the demand for electricity. Total cost of the whole project is estimated at £121½ million, but only some £40½ million of external financing would

be needed. Ultimate total generating capacity would be 1,300 MW. It is estimated that if 0·6d per unit is provided from existing electricity tariffs for financing the Kurwasa dam plant section, a substantial reduction in tariffs should be possible in ten years, and the project should by then be completely self supporting. Such a project could obviously bring considerable benefit to large parts of Nigeria, and it is to be hoped that the present proposals will soon be acted upon.

INDIA

More Cable Works

Yet another cable factory is to be built in India, this time with Japanese collaboration. The £300,000 factory is being established at Tripunithura, near Ernakubam, in Kerala, and that State Government is subscribing £75,000 to the share capital of the company. The factory is to produce insulated wires and cables of all types, and bare copper wires, production target being goods worth £750,000 initially and, ultimately, to treble that amount.

Nuclear Competition

In addition to Britain, Russia and the USA, France has also become interested in India's plans for nuclear power stations. A delegation of French atomic energy experts arrived in New Delhi last month. It is understood that according to a tentative proposal of the Indian Atomic Energy Commission, the country's second nuclear power station, proposed to be located in the Delhi area, should be of 75 MW and should use enriched uranium. The nuclear power station already proposed for Ahmedabad region is likely to consist of two 150 MW reactors which will be fed with natural uranium. When the delegation from the USA were recently in India, they indicated that they would not be interested in tendering for the Bombay-Ahmedabad plant because it would use natural uranium.

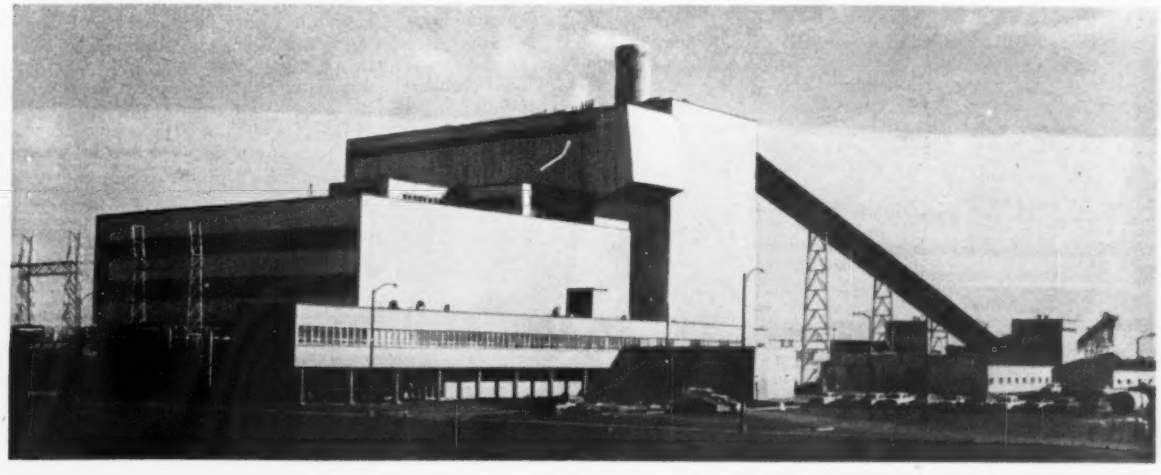
HONG KONG

Nationalisation Argument

The recommendation, by a commission, that Hong Kong's two private electricity supply undertakings should be compulsorily acquired and replaced by a single independent public authority (ELECTRICAL TIMES, 17 March issue), has received a mixed reception locally, it seems. The Hong Kong General Chamber of Commerce, for instance, has stated that "it is of the opinion that nationalisation is not in the best interests of the Colony as a whole, and it hopes that some solution, other than nationalisation, acceptable to all concerned, can be found." On the other hand, Mr N. V. A. Croucher, chairman of the Hong Kong Stock Exchange, admits that it is ludicrous that two power houses should be within two or three miles of each other and yet be separate entities. He considers it is time the two companies got together over the matter, and if one is unwilling, the Government should make them. The suggestion by the Commission that shareholders on the two companies should be compensated with 6½% Government stock redeemable in 35 years has also been criticised from the stockholders' point of view. It has been made clear that the proposed acquisition does not imply any criticism of the operations of the two undertakings. In fact the members of the Commission gave them both a pass with credit on technical and administrative efficiency. But the Commission did refer to the intransigent attitude of the two companies—the latter maintained that if they were not to be allowed to continue operations on the present basis, the only practical alternative was that they be taken over by an outright purchase of the shareholders' interests at agreed values and that the Government be then left to operate the companies itself. Future action will be important, for whatever the Government finally decide on the electricity supply issue will probably be accepted by the local community as an applicable precedence for other utilities. Meanwhile the Government has issued a warning that the assets of the two undertakings must not be dissipated.

BOUNDARY DAM OFFICIAL OPENING

Saskatchewan Power Corporation's new Boundary Dam generating station, near Estevan, shown below, is to be officially opened by Gen A. G. L. McNaughton, chairman, Canadian section of International Joint Commission, on 14 May. The station has, in fact, been in service for several months, and now has two 66 MW Parsons turbo-alternators installed, steam conditions at the t.s.v. being 850 p.s.i.g. 900°F. No. 1 boiler was supplied by Babcock-Wilcox, Goldie and McCullough Ltd., and No. 2 by Combustion Engineering Superheater Ltd. George Kent (Canada) provided boiler instruments and controls. Engineering consultants for the plant are Ewbank and Partners (Canada) Ltd., a subsidiary of the British company of the same name. This is believed to be the first completed thermal power station in Canada in which the consultant services have been provided by the associates of a British firm of consulting engineers. Fuel used in the station is Souris Lignite, of which there are large deposits in the area, mined on the open-cast method. To ensure adequate cooling water supply for the plant an earth dam was built on Long Creek, a tributary of the Souris River, to form an artificial lake. Because the backwater extends almost to the international boundary, the dam has been called Boundary Dam and the generating station named from it. Ultimate capacity will probably be about 264 MW



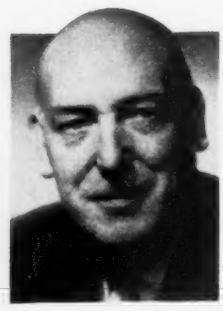
Personalities *in the industry*

Mr J. A. Rodgers

Mr J. W. Roberts

Mr R. P. Janion

Mr H. F. Castle



Mr H. D. Weeks

British Insulated Callender's Cables Ltd. announce that, as from 1 April, **Mr J. A. Rodgers,** A.M.A.M.E.M.E., formerly assistant sales manager (mining), has been promoted to divisional sales manager (accessories). Mr Rodgers joined the Sheffield office of BICC in 1953 as sales engineer (mining) covering the North East Division and part of the East Midlands Division of the National Coal Board. In 1957 he became assistant sales manager (mining) based at Leigh and two years later transferred to London, assuming responsibility for the development of all mining products in addition to his previous duties. Educated at Ridgeway School, Derbyshire, and the Sheffield and Liverpool Technical Colleges, he served an apprenticeship with Metropolitan Vickers Electrical Co. Ltd. There followed war-time service in the Mercantile Marine as an electrical engineer officer aboard such ships as the *Aquitania* and *Ascania*. Subsequently in 1947 he spent a short time with English Electric Co. Ltd. in Liverpool before joining Samuel Fox and Co. Ltd. at Stocksbridge on the staff of the chief electrical engineer, holding this position until he moved to BICC in 1953.

Mr John Stone, vice-chairman, has resigned from the board of J. and F. Stone Lighting and Radio and subsidiary companies following differences of opinion with the board. Mr Stone, who is 71, retired from the position of managing director in August, 1958.

District manager at Barnstaple to the South Western Electricity Board since 1948, **Mr R. Robinson,** M.I.E.E., A.M.I.MECH.E., M.I.MIN.E., retired at the end of March. Mr Robinson was also borough electrical engineer there from 1939 to 1948. His successor is **Mr J. W. Roberts,** A.M.I.E.E., who has been manager of the board's Central Cornwall district since 1950 (*ESH, pages 99 and 102). Mr Robinson was educated at Barnsley Grammar School, and at Sheffield University where he graduated in engineering; he then was appointed electrical engineer to the Fitzwilliam estate. Later he worked as a survey engineer for the British Engine, Boiler and Electrical Co., and from 1930 to 1939 served as HM electrical inspector of mines and quarries at Cardiff. Mr Robinson is also a governor of the North Devon Technical College, and a member of the local St. John Ambulance Association. To mark his retirement, he has presented a trophy —"The Robinson Cup"—to be awarded annually to the pair (male or female) receiving the highest marks in the area finals of the S.W. Electricity Board District Ambulance Competition. The new district manager at Barnstaple, Mr Roberts, is 47. He was educated at Weihai-Wei, North China, and Ardingly College, Sussex, and then went to take an Honours Diploma at Faraday Hse Engineering College. From 1935 to 1941, he held various engineering posts with the Cornwall Electric Power Co. and then was appointed branch manager at Camborne. In 1947, he was promoted to be their S.W. district manager.

Mr R. P. Janion has been appointed sales engineer of the Switchgear Division at the Witton Works of the General Electric Co. Ltd., responsible for switchgear for voltages of 3·3 kV and above. Mr Janion joined the company as a student apprentice in 1946 and was subsequently appointed a switchgear estimator. From 1953 onwards during his period of National Service he served in the Royal Corps of Signals and rose to the rank of lieutenant. On demobilisation, he returned to GEC and took up a position in the Business Development Department where he remained until, in 1956, he joined the switchgear sales department of the English Electric Co. Ltd. In 1958 he again returned to GEC as an assistant engineer at the company's branch office in Birmingham.

Formerly sales promotion manager of Ada (Halifax) Ltd, **Mr N. Bushell** has been appointed sales manager of Pakamac Special Products Ltd.—the new company formed by Pakamac Ltd., of Oldham, to market domestic refrigerators under the brand name of Pakamatic. Mr Bushell has spent 17 years in wholesales distribution of electrical appliances in England and Wales.

Mr F. C. Winfield, M.I.E.E., FEL.A.I.E.E., retired from partnership in Merz and McLellan, consulting engineers, at the end of March, but he has agreed to continue his association with the firm as a consultant.

Mr H. C. Drayton has been appointed a director of British Insulated Callender's Cables Ltd.

District manager at Crewkerne to the South Western Electricity Board since 1956, **Mr H. F. Castle** is to retire on 28 April, and will be succeeded by **Mr H. D. Weeks,** B.SC.(ENG.), A.M.I.E.E., (*ESH, page 100). Mr Castle entered the electricity industry in 1916 when he joined the Leatherhead and District Supply Co.; two years later he was promoted to be their chief assistant engineer. He relinquished this post to enlarge his experience in the engineering and commercial branches of the industry, serving with Banks, Warner and Co. Ltd., London, as draughtsman and engineer, and later with Plenty and Son Ltd., of Newbury. Mr Castle returned to the electricity supply industry in 1926 when he was appointed chief assistant engineer to the Basingstoke undertaking. In 1929, he became engineer and manager of the borough of Bridport electricity undertaking, and was responsible for the initiation and development of a public supply to the town and surrounding rural district. On transfer of the undertaking to the S.W. Electricity Board in 1948, Mr Castle continued in his post as manager. In 1955, he was appointed acting manager of the Minehead district, and in 1956 became manager of the board's Crewkerne district. Mr Weeks, who is 44, was manager of the board's former

** Denotes revision to the "Electricity Supply Handbook, 1960."*

Taunton district until 1958 when he took up a post in the chief engineer's department at head office in Bristol. Born in Manchester, Mr Weeks was educated at Bath and at Bristol University where he took a degree in engineering; he first joined Ferranti Ltd. as a transformer designer and then (in 1937) the Weston-super-Mare Electric Co. Two years later he transferred to Torquay Corporation electricity department and, in 1946, was promoted to distribution engineer. With nationalisation of the industry in 1948, Mr Weeks was appointed to be the S.W. Electricity Board's Torquay and West Devon sub-area engineer; in 1950 he was promoted to be manager of Taunton District.

Mr J. A. Bailey has been appointed deputy chairman of the Mond Nickel Co. and of Henry Wiggin and Co., and **Mr E. Vaughan** has been appointed a director of both companies.

Retiring from the position of deputy station superintendent at North Tees "A," "B" and "C" power stations, **Mr T. E. Graham** was the recipient of a presentation recently from colleagues and friends.

Mr J. O. Sewell has been appointed general manager of the British Materials Handling Division and the British Lock and Hardware Division of the Yale and Towne Manufacturing Co.

Further new appointments within the five separate groups formed by the re-organisation of the General Products Group of the General Electric Co. Ltd. operative from 1 April, are announced. Each of these new Groups is under the control of a group managing director who is responsible for overall planning and direction (their names were reported on 7 Jan. last). The new appointments are as follows:

DOMESTIC EQUIPMENT GROUP

Mr D. E. Kidner is group sales manager, and will continue to be located for the time being at North London branch, Ealing.

Installation Equipment Division

Mr H. F. North, is designated sales manager (he was earlier manager of the firm's Blackburn branch) and **Mr S. J. M. Hoult** is supply manager.

Pirelli-General Cable Division

Manager is **Mr F. E. Everard,** a past-chairman of the Rubber and Thermoplastic Cable Manufacturers' Association.

Switchfuse, Gear and Accessories Division

Manager is **Mr J. B. Smyth** and deputy manager is **Mr P. E. Wheatland,** earlier deputy general manager of the Installation Equipment Division.

Conduit Division

Mr J. L. Simpson is the manager.

LIGHTING AND HEATING GROUP

Lighting Division

Manager is **Mr W. A. Villiers,** B.SC., A.C.G.I., A.M.I.E.E., who has been deputy general manager of the Lighting Division. The commercial manager is **Mr D. W. Durrant.** Technical sales manager is **Mr C. Dykes-Brown** who has been manager of the Illuminating Engineering Division. **Mr A. C. C. Moore** has been named manager of GEC Lighting Equipment Ltd. (River Works).

Industrial Heating Division

Manager is **Mr A. L. Dandy** and assistant manager **Mr C. A. King.**

Market Development

Mr Ivor Williams, M.B.E., is manager, and will be responsible for the appointment, training and directing, through Group area sales managers, of a general sales force to serve both Divisions. Earlier, Mr Williams was manager of the Domestic Equipment Dept. and in October, 1958, was appointed sales development manager for the General Products Group.

Magnet Works

Mr A. R. Green is the general manager, and **Mr S. A. Ritchie** group accountant.

OSRAM GROUP

Osram Lamp Division

Mr W. J. A. Woodward is named general manager, manufacture and development; **Mr A. H. Willoughby** is technical manager; **Mr L. A. Mills** is general sales manager; **Mr S. F. Stringer** overseas sales manager; **Mr S. K. Hardy** chief accountant; and **Mr H. O. Weare** administration manager.

RADIO GROUP

Mr A. E. Frost is group sales manager, and **Mr R. G. E. Mayo** group commercial manager.

Mr N. A. Mackay has retired from the position of sales manager of Transformers (Watford) Ltd. after 50 years' service in the electrical industry. His successor is **Mr C. J. Penny** who joined the company three years ago as assistant sales manager, and is also well known as the indefatigable secretary of the ASEE Golfing Society. Earlier, Mr Penny was with the Brush Electrical Engineering Co., following a period with Mersey Cable Works Ltd. as sales engineer in London and southern counties.

Mr Ivor Williams

Mr C. J. Penny

Brig C. A. Zweigbergk

We are now able to reproduce, above, the portrait of **Brig C. A. Zweigbergk,** C.B.E., M.SC.(TECH.), M.I.E.E., whose appointment we exclusively reported last week, as the first director of the new British Electrical Approvals Board for domestic appliances which is being established. As we then stated, Brig Zweigbergk will take up his new duties on 1 June. As director in charge of the Electrical Inspection Directorate of the Ministry of Aviation (formerly MoS) for the past three years, he has been responsible for all the electrical and electronic equipment destined for use by the Army and RAF.

Major-General Sir Miles Graham has been elected chairman of A. C. Cossor in succession to **Lord Exeter** as from 1 April. Sir Miles is already vice-chairman of the company. He is also deputy chairman of Franco Signs, vice-chairman of Prior Stokers and is on the boards of several other companies.

Mr W. J. Darby has retired from the board of Vactric Ltd.

Mr P. B. H. Brown has been appointed chairman of L. Sterne and Co. in the place of **Sir Samuel R. Beale** who has retired. Mr Brown retains his post as managing director. **Mr J. Dunlop** has been appointed an additional director of the company.

At his own request, **Sir William Garrett** relinquishes his executive responsibilities with Monsanto Chemicals

Mr D. E. Kidner

Mr H. F. North

Mr F. E. Everard

Ltd. on 1 April, in order to devote more time to his other interests. He will continue as a member of the board (Sir William is a director of Metal Industries). Since 1957 he had, among his other executive activities, held the position of personnel director of Monsanto Chemicals Ltd. These duties will now be assumed by **Mr N. F. Patterson,** director in charge of engineering and purchasing.

Sir Willis Jackson, president of the IEE, and **Mr W. K. Brasher,** secretary of Institution, are now in Poland for discussions on the training of electrical engineers, a visit sponsored by the British Council. They are expected back at the end of this week.

The longest serving member of the Midland Region of the AEI Lamp and Lighting Co. Ltd., **Mr H. V. Sayce,** has retired after 48 years' service with the firm, and to mark the occasion Mr G. Honnoraty, the Regional manager, recently presented him with a radio set on behalf of his colleagues and friends. Mr Sayce joined the BTH Co., Lamp and Wiring Supplies Division, in 1912 and after war service became a representative for Birmingham and the North Midlands in 1921. He opened the Cheltenham Depot in 1924 and was area superintendent there until his retirement. He is a past chairman and treasurer of the Cheltenham and Gloucester branch of the IES.

Mr H. V. Slade, managing director of Garrard Engineering and Manufacturing Co., has been elected deputy chairman of the company.

At the recent annual general meeting of the British Refrigeration Association **Mr C. M. Marks** (Hussmann British Refrigeration Ltd.) was elected chairman of the association and **Mr N. F. T. Saunders** (Kelvinator Ltd.) was elected vice-chairman.

Mr Nigel Jeffery Froy, a director of W. N. Froy and Sons Ltd., has been appointed joint managing director of the company.

Our photograph below shows the presentation of the William C. Yuille silver rosebowl by the president, **Mr F. J. Blackwell,** at the Federation's annual general meeting. The trophy is awarded annually to the EWF section which makes the highest contribution per member to the Federation's collection in aid of the EIBA. It is being accepted by **Mr Cyril Smith** (Cricklewood Wholesale Electric Ltd.) the EIBA collector for the London and eastern section. After the presentation, the rosebowl is, by tradition, passed round to members for their contributions and at this year's meeting the collection reached the record figure of £156 1s.

Mr. C. Smith, left, receives the bowl

Mr D. A. Hughes has been appointed chief engineer of the Ministry of Health and the staff concerned are being transferred to the Ministry following the decision by the Minister of Health and the Minister of Housing and Local Government that, in future, their Ministries should have separate engineering establishments. Previously engineers working on behalf of the Ministry of Health have formed part of the staff of the Ministry of Housing and Local Government.

Manager of the Tyne sub-area of the North Eastern Electricity Board, **Mr J. F. Skipsey,** B.SC., M.I.E.E., has been appointed a member of that board while continuing to serve as a full-time officer. The Minister of Power has reappointed **Major C. L. Baldwin,** M.C., J.P., as a part-time member of that board, and **Col E. G. Angus** and **Mr J. Bowman** have retired on completing their terms of office. (*ESH, page 149.)

Charge engineer at Staythorpe power station, **Mr H. Brockelsby** has been elected president of the Electrical Power Engineers' Association.

Mr E. A. Cullen, M.I.E.E., engineer to the Essex sub-area of the Eastern Electricity Board, is shortly to retire. His successor will be **Mr G. M. Holland,** M.I.E.E., A.M.B.I.M., now Fens sub-area engineer. The latter post will be taken over by **Mr H. T. Ransley,** now senior assistant engineer, development section, chief engineer's department. (*ESH, pages 107/8).

Hitherto sales manager, London and the south, **Mr D. W. Parks** has been appointed sales promotion manager of Tricity Cookers Ltd. Mr Parks joined the South Western Electricity Board after graduating from Bristol University. He joined Tricity Cookers early in 1955 and became southern area manager in 1957 and sales manager, London and the south, in 1959. **Mr G. A. Bilsland,** who has been appointed to succeed him in the latter position, has been with the General Electric Co. since 1929, apart from military service. He started with GEC as a commercial trainee and later joined the Industrial Heating and Cooking Department. Following military service he joined the Domestic Equipment Department as deputy manager, with responsibility for electric cookers and, later, refrigerators. A third new appointment in the Tricity organisation is that of **Mr C. L. Holliday** as area manager, London area. He has had 34 years' experience in the industry and joined Tricity in 1952 after being London area representative for Elexcel Ltd. Prior to RAF service he was with Siemens Electric Lamps and Supplies.

Mr M. Haddon-Grant, LL.B., has been appointed assistant secretary of the Plessey Co. Ltd.

A presentation of a television set was made to **Mr F. V. Pipe** by his colleagues and friends at Newton Brothers (Derby) Ltd. on his retirement on 31 March after 42 years with the company, of which he has been managing director for the past 22 years. In 1950 he was appointed chairman of the board, from which position he retired in 1958. Prior to joining NBD Ltd. he was with the BTH Co. Ltd. at Coventry. **Mr J. A. Garnett** has accepted an invitation to join the board of Messrs Newton Brothers (Derby) Ltd., as we indicated last week.

In celebrations to commemorate the 21st anniversary of the Backer Electric Co. Ltd., presentations were made to **Mr S. G. Nimrod,** deputy managing director, and **Mr S. Davis,** works manager and alternate director—both of whom joined the company when it was founded.

Lt-Col W. H. L. Gordon and **Sir Douglas Harris** have been reappointed members of the Uganda Electricity Board for a further period of two years, and **Mr J. T. Simpson** and **Mr C. C. Spencer** for one year.

OBITUARY

Mr R. E. Williams, representative for Falk, Stadelmann and Co. Ltd., in the Egham, Staines, Guildford and Aldershot areas since 1932, died recently.

Mr Stanley Barnett, M.SC.(TECH.), M.I.E.E., A.M.I.MECH.E., Head of the Department of Electrical Engineering at Huddersfield College of Technology for the past 11 years, died on 1 April, aged 57. Mr Barnett was awarded his M.SC.(TECH.) for work carried out at the research department of Metropolitan-Vickers Electrical Co. Ltd. He also gained experience at the Dick Kerr Works, Preston, after which he served as assistant designer to the English Electric Co. Ltd. In 1941 he took up an appointment as full-time lecturer in electrical engineering at Constantine Technical College, Middlesbrough, holding that post till 1947 when he took over a new position as senior lecturer in electrical engineering at Blackburn Municipal Technical College and School of Art.

Mr E. W. Farr, a director of Hackbridge Holdings Ltd. and also of the Hackbridge Cable Co. Ltd., died on 1 April, aged 68. He had been associated with the Hackbridge group since 1918.

We should make it clear that the J. L. Brook, whose death at the age of 79 we reported last week, was **Ald J. Louis Brook,** a former vice-chairman of Brook Motors Ltd. and brother of the company's founder.

Ald Robert Neill, M.I.MECH.E., M.I.M.E.M.E., head of the electrical engineering firm of Robert Neill and Co. (Sheffield) Ltd., which he founded in 1919, died on 28 March, aged 76.

U.S. engineers look to the future of generation

ECONOMICS OF LARGE SETS AND PEAKING DISCUSSED

POLICY for power supply generation in the future receives attention in several of the papers presented at the 23rd American Power Conference last month, held in Chicago under the auspices of Illinois Institute of Technology. Amongst subjects with a particularly topical interest for engineers in the UK is that of the economics of very large turbine-generating units. Does it pay to go as big as 800 MW? The answer in the affirmative is given by Mr J. R. Carlson, division engineering manager of the steam division of Westinghouse Electric Corporation.

Mr Carlson says that many US supply authorities are installing turbine-generator units of 300 to 350 MW capacity, and that studies have been made of installations of 500 and 600 MW capacity. In such studies, the question is often asked, what is the advantage of the very large turbine generator unit over the one-half-size machines? This question has been investigated with the help of consultants (United Engineers and Constructors, Inc.) for plants of 2 by 400 MW and single sets of 600 MW and 800 MW; and also for a 2,400 MW station equipped with 600 or 800 MW turbine-generator units.

In all the studies, cross-compound sets were considered, operating at 2,400 lb/sq in, 1,050/1,000°F. Pulverised coal firing was assumed. For the 400 MW set, a machine with both lines running at 3,600 r.p.m. was assumed, with four sets of 28 in. exhaust blading. The 600 MW machine was assumed to be a 3,600/1,800 r.p.m. design, with four sets of 40 in. blades at the exhaust end, and the 800 MW machine, again with both lines running at 3,600 r.p.m., with eight sets of 28 in. blades at the exhaust. Efficiencies are given in Table 1, and the paper breaks down capital costs in considerable detail. Fixed charges are assumed to be 14% per annum on capital cost, and the fuel cost as 25 cents/million B.Th.U's. On this basis Fig. 1 gives the overall results of the studies, and Table 2 the first cost in kW terms.

Table 1. Station and turbine heat rates assumed in large set studies

MW	Heat rate B.Th.U./kWh	Boiler eff.	Station Auxy. %	Station heat rate
800	7,500	90	3·5	8,636
600	7,425	90	3·5	8,549
400	7,510	90	3·5	8,647

Table 2. First cost estimates, complete stations

2 by 400 MW	$155/kW	3 by 800 MW	$128/kW
800 MW	$139/kW	4 by 600 MW	$135/kW
600 MW	$152/kW		

Availability

Mr Carlson makes the point that availability records maintained by the prime movers committee of Edison Electric Institute have shown several points reduction in availability in the top classification of pressure, temperature and rating; but in the section immediately below, where there is more operating experience, the availability is well above 90%. He argues that this implies that availability in the top class should increase rapidly now that there are many sets in this category in operation. He goes on to predict that sub-critical pressures will be used in steam plants for some time to come, except for a few experimental units.

Can high availabilities be maintained on sets as large as 800 MW? Throttle and governor valves should cause no trouble with greater steam flows; it is possible merely to use more. Of greater concern may be the reliability of the steam flow blade path, of which the first and last stages are the most critical. Double-flow arrangements for the first stage can double output without increasing the nozzle height, and can bring balance of steam torques at partial admissions. Deflection of the h.p. turbine shaft may be a problem.

Early large turbine designs have had an apparently high production cost; and in 600 and 800 MW sizes this might continue because of the limited market and consequent high cost of special patterns and tools. The Westinghouse approach is to develop standard "pre-engineered" turbine components that may be used singly or in multiples to produce large machines.

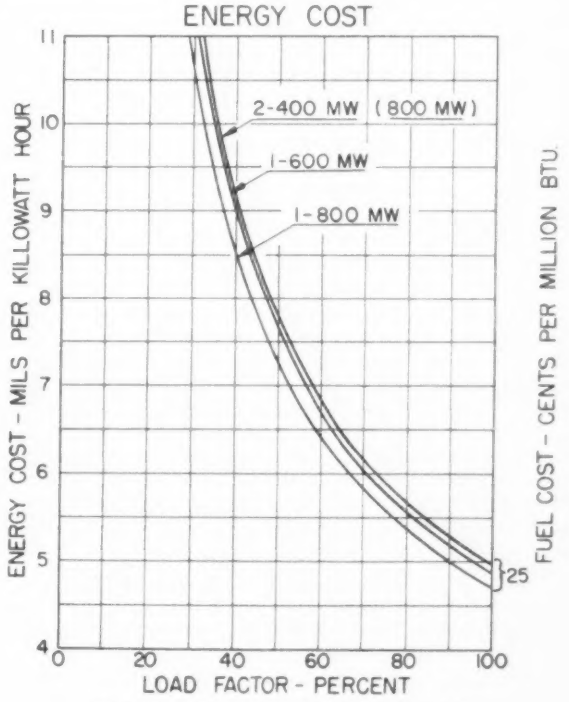


Fig 1. Generation cost comparisons for large sets

Table 3. Characteristics of sets considered for system expansion

Type	Capacity MW	Heat rate B.Th.U. kWh	Start-up cost $
Conventional steam	150	9,088	235
Conventional steam	225	8,990	310
Conventional steam	300	8,990	350
Spinning reserve ...	150	10,720*	175
Spinning reserve ...	225	10,610*	235
Spinning reserve ...	300	10,610*	310
Peaking gas turbine	25	16,000	17·5

* At full output; heat rates at 109·5, 163 and 217 MW, respectively, are the same as for conventional sets of the same maximum capacity.

New Concepts

The larger sets discussed by Mr Carlson are essentially an extension of current practice. Some novel generation concepts and the ways in which they may be applied are discussed in another paper by Messrs A. G. Mellor and W. D. Marsh, both of the General Electric Company of Schenectady, NY.

Their starting point is the prevailing practice of adding to a system the highest-efficiency steam-electric generating units that could be justified on the basis of a fairly high lifetime load factor. This practice has developed in part because of the rapid increase in efficiency of generation. As each new unit has come into service, it has been placed on base load duty.

Two factors have relatively recently made it necessary to rethink this practice. First, each step forward in raising steam conditions has resulted in smaller gains in station efficiency, and each step has become more difficult and more expensive. Second, new types of generation have become available that offer the opportunity of lowering installed cost per kW, though at some sacrifice in fuel cost per kWh.

There are three main types of "new" generating units:

Advanced cycles. These include higher temperature and pressure conventional units, and combined gas turbine-steam turbine generating units. The authors suggest that present opinion is that 2,400 lb/sq in., 1,050°F initial temperatures, 1,000°F reheat represents the maximum that can be justified under normal circumstances; but they add that considerable efforts are being made to break this "barrier". Combined cycles are receiving increased attention. A combined cycle, whether as an exhaust-fired unit or as a supercharged boiler cycle, offers an appreciable gain in net station thermal efficiency over a conventional steam cycle for given temperatures and pressures.

Spinning reserve generating units. This concept envisages a steam turbine designed for a nominal rating of, say, 217 MW. At this rating it would have high efficiency, comparable with the best available. It would be designed, however, to deliver as much as 300 MW for short periods. The increased capability might be obtained by increasing steam pressure while dropping steam pressure, or through by-passing the h.p. stages of the turbine to obtain greater steam flow. In both cases, there will be considerable loss of efficiency (Table 3), and clearly, there must be revelopments in boiler design as well as turbines.

Peaking generation. Included under this heading are: hydro generation with pondage or storage; pumped storage hydro; low-cost steam plants; and gas turbine or diesel plants. The authors observe that the possibility of lower-cost steam generating units having worse efficiency for peaking purposes has been under investigation afresh recently. The concept is to use lower steam conditions, non-reheat generating units, and to eliminate some of the normal heat-recovery equipment.

The main part of the paper is devoted to an analysis of how units of the type discussed (except hydro) might be incorporated in an existing system, without unduly close regard to overall evaluation of the economics of the alternatives. A system of 1,150 MW installed capacity is considered, with 16 sets ranging from 25 MW to 150 MW, and with full-load heat rates from 21,730 to 9,088 B.Th.U/kWh. System load factor is assumed just under 59%, with a summer air conditioning peak 75% of the succeeding December system peak.

From the detailed cost studies, the authors conclude that the addition to the system of moderate amount of spinning reserve steam turbine capacity results in only a small production cost penalty. This reserve will operate for only a few hours a year above its base capacity. Heat rate of any specifically peaking generation added to the system will have little effect on the fuel cost penalty incurred; but it will have a large effect on the number of hours for which the peaking plant is operated, assuming incremental cost loading is used. The saving in operating cost obtainable, for example, with unattended remote controlled gas turbines, stands out as a major factor in peaking generation economics.

The authors warn that the load factor at which a generating unit will operate during its life depends on the efficiency level of units subsequently added to the system as well as on its own efficiency level. This tends to make rule-of-thumb evaluations unrealistic, and possibly misleading. Amongst the figures backing-up the paper are those given in Table 3, which also indicates the types of set considered.

Probing the Cosmos

COSMIC radiation has always been shrouded with an unusually impenetrable air of mystery, but at last week's Kelvin Lecture, Professor C. F. Powell, F.R.S., explained current theories of their nature and origin so lucidly that, as Sir Noel Ashbridge commented in his vote of thanks, if only for a moment the mysteries were dispelled.

Coming out of space and incident on the upper atmosphere is a fine rain of fast-moving atomic nuclei called primary cosmic radiation. These particles have great kinetic energy and in entering the earth's atmosphere, they make collisions which change their nature; an original nucleus of iron, for example, might fragment and be replaced by two or three lighter nuclei of smaller charge. To investigate the nature of cosmic rays before such fragmentation could occur, balloons are used flying at heights in excess of 100,000 ft.

Although 90% of cosmic radiation consists of hydrogen particles, and no elements heavier than nickel and iron have been found in it, two factors give a clue to the origin of the radiation. Relative to hydrogen, nickel and iron are ten times more abundant than in the ordinary matter of the universe, and lighter elements like lithium beryllium and boron are a million times more abundant.

The nickel-iron content is thought to be originally formed by condensation of the core matter of stars under the influence of enormous gravitational forces and nuclear reactions. Condensation causes instability, the star explodes and forms a super nova. In the explosion nickel-iron particles are expelled from the star. It seems probable that the lighter particles present in cosmic radiation do not originate from the super nova directly, but are formed by the heavier particles ejected from it colliding with particles of interstellar gas and fragmenting.

Surge characteristics

A SURVEY OF TECHNICAL DATA—PART 2

compiled by H. E. Green, B.Sc. (Eng.), A.M.I.E.E.

IN calculating the effect of surges on generating, transmission and distribution systems in accordance with established theory* it is necessary to know the values of certain characteristics, particularly the surge impedance and electrostatic capacitance of individual items of equipment.

It is only very rarely that exact information is available for the particular circuit under consideration and it is therefore necessary to make approximations based on typical figures representing as nearly as possible the plant in question. These notes present suitable figures. Part 1 dealt with overhead lines, waveform, the reflection of waves, and transformers.

Transferred Surges

Surges may reach a transformer from either the primary or secondary side depending on the type of network, e.g., line or cable, to which either side is connected; they can also be transferred from one winding to the other.

The phenomenon of transferred surges can be subdivided into two main components, electrostatic and electromagnetic. Electrostatically transferred surges depend on the mutual capacitance between windings and their capacitance to ground and are independent of the turns ratio. Electromagnetically transferred surges are directly proportional to the turns ratio.

In the case of electrostatically transferred surges, the amplitude is reduced by an increase in load capacitance and capacitors are sometimes installed on the secondary side for this purpose. The capacitance of cables is often sufficient to reduce the overvoltage to a safe value.

Table 4. Capacitance of Single-core Oil-filled Cables

Section sq in.	Capacitance μF 1,000 yards		
	33 kV	66 kV	132 kV
0·10	0·43	0·29	0·17
0·15	0·47	0·34	0·18
0·20	0·50	0·36	0·19
0·25	0·53	0·38	0·21
0·30	0·55	0·41	0·22
0·40	0·60	0·44	0·24
0·50	0·64	0·49	0·26
0·60	0·69	0·52	0·28
0·75	0·73	0·56	0·30
1·00	0·82	0·65	0·34

Note: The above figures are for cables with 12 mm oil duct.

Reference

"High Voltage Cables," BICC Ltd. Publication No. 225A (Second Edition), first issued March, 1948.

* Pt. 1 was published in the ELECTRICAL TIMES on 17 March, 1960, p. 409.

Cables

For a single core cable with a solid inner conductor of radius r, inside a sheath of radius R and insulation of permittivity k, the capacitance C is given by:

$$C = \frac{k.10^{-11}}{18.\log_e(R/r)} \quad \text{farads/cm.}$$

The surge impedance Z is given by:

$$Z = \frac{60.\log_e(R/r)}{\sqrt{k}} \quad \text{ohms.}$$

Table 5. Surge Impedance of Single-core Oil-filled Cables

Section sq in.	Surge Impedance: ohms		
	33 kV	66 kV	132 kV
0·10	27·2	34·0	48·5
0·15	25·6	31·0	46·3
0·20	24·6	30·0	44·6
0·25	23·8	28·9	41·9
0·30	23·2	27·5	40·5
0·40	22·0	26·3	38·2
0·50	21·1	24·6	36·2
0·60	20·2	23·7	34·4
0·75	19·4	22·7	32·9
1·00	18·1	20·7	30·5

Note: Calculated from $Z = \sqrt{(L/C)}$ for cables with 12 mm oil duct.

Reference

"High Voltage Cables," BICC Ltd. Publication No. 225A (Second Edition), first issued March, 1948.

Table 6. Surge Impedance of Cables

Z ohms	Remarks	Reference
37**	138 kV gas-filled 0·35 sq in. cable	T. Ingledow et al.
28*	120 kV high-pressure gas-filled cable	Armstrong, Howard & Johnson
26*	69 kV 3-core medium-pressure gas-filled cable	Valentine, Dillard & Clayton
25*	40 kV 3-core low-pressure gas-filled cable	
23*	15 kV 3-core 'H' type cable	
18*	15 kV 3-core 'H' type cable	

* Test. ** Calculated from $Z = \sqrt{(L/C)}$

References

T. Ingledow *et al.*: "British Columbia-Vancouver Island 138 kV Submarine Power Cable," IEE Paper No. 2354 S, April, 1957.

H. R. Armstrong, S. B. Howard and I. B. Johnson: "Field Investigation on the Surge Performance of a Large Unit-Connected Steam Turbine Generator," Transactions AIEE, Vol. 71, Part III, pp. 1023-1029, December, 1952.

W. W. Valentine, J. K. Dillard and J. M. Clayton: "Surge Attention in Power Cables," Transactions AIEE, Vol. 74, Part III, pp. 1115-1122, December, 1955 (AIEE paper No. 55/558).

Table 8. Capacitance of Busbars

Item	Capacitance $\mu\mu$F/phase	Reference
154 kV sub-station busbars	8,800	Kitani et al.
Average of various Stations	2,000	Allibone & Perry
Maximum Average Minimum	15,000 5,000 2,000	Miller
Average of various 132 kV sub-stations	1,700*	Vosper

* Approximately 14 $\mu\mu$F/yd. per phase.
Note: 1 pF = 1$\mu\mu$F.

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Y. Kitani, T. Sakai, Y. Hirose, Y. Osaki and J. Nakagawa: "Surge Characteristics of Suruga Substation Bus Circuit," JIEE, Japan, Vol. 74, No. 2, pp. 166-169 (February, 1954). In Japanese. (Science Abstracts, Vol. 58B, 1955, No. 893.)

T. E. Allibone and F. R. Perry: "Standardisation of Impulse-Voltage Testing," JIEE, Vol. 78, pp. 257-284 (March, 1936).

J. L. Miller: "The Influence of Certain Transmission-Line Associated Apparatus on Travelling Waves," JIEE, Vol. 74, pp. 473-510 (June, 1934).

J. S. Vosper: "Restriking Voltage Characteristics Self-Capacitances of H.V. Transformers, Reactors and Busbars," ERA Report G/T. 272, 1953 (Abstract: ELECTRICAL TIMES, 18 February, 1954, p. 249).

Table 9. Capacitance of Transformer Bushings

Voltage kV	Type	Capacitance $\mu\mu$F	Reference
66	condenser	150	*Elec. Times*
100	not stated	200	Miller
132	condenser	250	*Elec. Times*

Note: 1pF = 1$\mu\mu$F.

References

ELECTRICAL TIMES, Vol. 88, p. 168, 8 August, 1935.

J. L. Miller: "The Influence of Certain Transmission Line Associated Apparatus on Travelling Waves," JIEE, Vol. 74, pp. 473-510, June, 1934.

Table 10. Capacitance of Circuit-breaker Bushings
Representative Minimum Values of Bushing Capacitances*

Voltage kV	Capacitance $\mu\mu$F	
	Oil-filled type	Condenser type
33	50	100
44	65	115
66	90	150
88	115	185
110	140	220
132	170	255

Note: 1 pF = 1$\mu\mu$F.

* Bushing capacitances vary over a wide range and can easily have twice the above values.

Reference

J. R. Mortlock: "The Evaluation of Restriking Voltages," Journal IIE, Vol. 92, Part II, pp. 562-579, December, 1945.

Table 7. Velocity of Travelling Waves

$$v = c/\sqrt{k\mu}$$

Item	Dielectric	k	μ	v ft/μs	Remarks	Reference
Overhead Line	Air	1·0	1·0	984	k = 1·00059	
Transmission Line Towers	Steel Conductors in Air	1·0	>1·0	940	345 kV tower	Breuer et al.
		1·0	>1·0	905	138 kV tower	Caswell et al.
Cable	Paper			475	120 kV high-pressure gas-filled cable	Armstrong, Howard and Johnson
		3·4	1·0	530	69 kV 3-core medium-pressure gas-filled cable	Valentine, Dillard and Clayton
		4·8	1·0	450	40 kV 3-core low-pressure gas-filled cable	
		3·6	1·0	520	15 kV 3-core 'H' type cable	
Transformer	Paper in Oil	3·5	1·0	526	Theoretical	
	Paper in Air	<3·5	>1·0	640	60 MVA 132 kV 3 phase transformer	Norris
	Cotton in Air		>1·0	328	33 kVA 33 kV 1 phase transformer	Ohkohchi and Yui
Rotating Machine	Mica in Iron slot, End windings in Air			45-240	Average over whole length of winding	Alekseev Kulakovsky
		5-8	>1·0	45-50	Calculated for slot portion only	Abetti, Johnson and Schultz

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G. D. Breuer, A. J. Schultz, R. H. Schlomann and W. S. Price: "Field Studies of the Surge Response of a 345 kV Transmission Tower and Ground Wire," Transactions AIEE, Vol. 76, Part III, pp. 1392-1396 (AIEE paper No. 57-1085).

R. W. Caswell, I. B. Johnson, E. F. Koncel, Jr. and N. R. Schultz: "Lightning Performance of 138 kV Twin Circuit Transmission Lines of the Commonwealth Edison Company—Operating Experience and Field Studies," Transactions AIEE, Vol. 76, Part III, pp. 1480-1491 (AIEE paper No. 57-1084).

H. R. Armstrong, S. B. Howard and I. B. Johnson: "Field Investigation on the Surge Performance of a Large Unit Connected Steam Turbine Generator," Transactions AIEE, Vol. 71, Part III, pp. 1023-1029, December, 1952.

W. W. Valentine, J. K. Dillard and J. M. Clayton: "Surge Attenuation in Power Cables," Transactions AIEE, Vol. 74, Part III, pp. 1115-1122, December, 1955 (AIEE paper No. 55-558).

E. T. Norris: "The Lightning Strength of Power Transformers," Journal IEE, Vol 95, Part II, pp. 389-406, August, 1948.

J. Ohkohchi and E. Yui: "Propagation Velocity of Lightning Waves in Transformer Windings," Electrotechnical Journal, Japan, Vol. 4, pp. 11-13, January, 1940.

B. A. Alekseev and V. B. Kulakovsky: "Impulse Testing of Inter-turn Insulation of High Voltage Machines," Elektrichestvo No. 4 (April), 1957, pp. 75-79.

P. A. Abetti, I. B. Johnson and A. J. Schultz: "Surge Phenomena in Large Unit Connected Steam Turbine Generators," Transactions AIEE, Vol. 71 Part III, pp. 1035-1047.

The surge impedance of a multi-core cable is given by:

$$Z = \frac{G}{0{\cdot}0169\ n\ \sqrt{k}} \text{ ohms.}$$

where G = geometric factor (see Bewley: "Travelling Waves on Transmission Systems," Fig. 27, page 393).
n = number of conductors.
k = permittivity of insulation.

For practical purposes the surge impedance of a cable is often taken as 50 ohms.

In addition to the case in which cables are connected to the l.v. side of a transformer, it is also necessary to consider the important case of a transmission line terminated by a transformer through a length of h.v. cable. The conditions occurring at the junction of the line and cable and at the junction of the cable and transformer must be considered, together with the various reflections which occur.

Tables 4, 5 and 6 give the capacitance and surge impedance of various h.v. cables.

Velocity of Travelling Waves

When a travelling wave enters a cable from an overhead line a change of velocity occurs and this must be taken into account when calculating the effect of reflections at the ends of the cable. This calculation is simplified by the construction of what is known as a "lattice diagram."

A travelling wave moves along a conductor with a velocity: $v = c/\sqrt{k\mu}$ where k and μ are respectively the permittivity (specific inductive capacity or dielectric constant) and magnetic permeability of the medium surrounding the conductor and c is the velocity of propagation of electromagnetic waves, i.e., the velocity of light.

The value of c is 3×10^{10} cm/sec = 984 ft/μs, but this is usually rounded off to 1,000 ft/μs for practical surge calculations.

The velocity of travelling waves in various pieces of equipment is shown in Table 7.

Rotating Machines

A typical case in which transferred surges may occur is that in which the low voltage side of a transformer is connected to a rotating machine, either motor or generator. The value of the transferred surge will be influenced by the characteristics of the machine, i.e., inductance and capacitance. Typical values of surge impedance for machines above 10 MVA are given in Fig. 2.

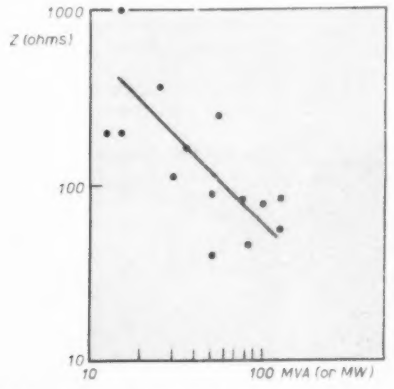


Fig. 2. Typical values of surge impedance for rotating machines of ratings above 10 MVA

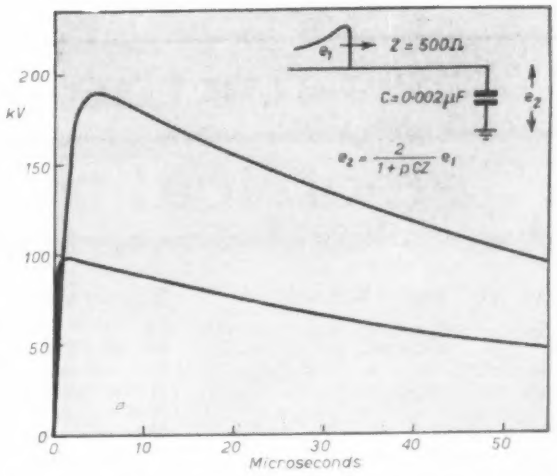


Fig. 3. Effect on shape and magnitude of 1/50 microsecond wave of capacitance at end of line; 0·002 μF busbars closing line. (e_2 wave top, e_1 below; e_2 = 190·5 kV, 5/55 microsecond)

Busbars and Bushings

In conclusion it may be noted that the capacitance to earth of busbars and bushings has some effect on the amplitude and shape of travelling waves, although in the majority of cases the effect is small. Tables 8, 9 and 10 give some figures for the capacitance of busbars, transformer and circuit-breaker bushings, respectively. Fig. 3 shows the effect on a 1/50 μs wave of a capacitance of 0·002 μF at the end of a line.

(Concluded)

Quick-action Switch

EXTREMELY fast action is a characteristic of the "ferreed", a new design of low-current electromechanical switch. This device, introduced by Bell Telephone Laboratories in America, combines the rapid switching of bistable magnetic material, as used in memories of electronic computers, with the metallic contacts for long-maintained output as in conventional switches. In several models of the device, a cobalt ferrite has been used as the magnetic material and a glass-sealed magnetic reed switch as for the output contacts—hence the name.

In operation, the magnetic material switched by a magnetomotive force applied typically as a five ampere pulse in a 30-turn winding. Control pulses as short as five microsecond duration will switch the magnetic material. The resulting closure of the contacts following the change of magnetic state may take several hundred microseconds. Cancellation of the magnetic flux by another pulse causes the contacts to open, and this operation is faster than for closing.

Initially application of the new device is likely to be in telephone switching. Several new magnetic materials are reported to have been evolved for use in the ferreed. Among them are ferrites exhibiting characteristics midway between those of permanent magnets and of computer memory materials, and suspensions of ferrites in plastics.

for the electrical trade

Low-level storage heater

ANOTHER night-storage heater has been introduced by GEC. This "Nightstor" model, designed for under window installation, is only 11¾ in. deep. Central elements are surrounded by heat-storage blocks which radiate warmth to the front and sides of the hammered bronze cabinet. Warm air, convected through a grid at the top, eliminates cold downdraughts from the window above. Ventilated panel in the back allows the unit to be installed without danger of overheating the wall.

These heaters comply with EDA recommendations regarding design and use of such appliances. "Nightstor" low-level model is 21¼ in. high and 27 in. wide. Price £12 12s 6d. *General Electric Co. Ltd., Magnet Hse, Kingsway, W.C.2.*

Double-speed drill

PENETRATION of both wood and masonry can be accomplished safely with the Rawlplug two-speed drill. This hand appliance, which serves the needs of both professional users and home handymen, can be operated at a special slow speed of 420 r.p.m. when working on masonry, thus eliminating the danger of damaged drill heads. Durium drills, recommended for masonry boring, are sold with vouchers covering the cost of the first resharpening.

Pistol grip enables maximum manual pressure to be applied, and trigger control can be locked for continuous operation when necessary. The chuck is adjusted for release or insertion of drills by the rotation of a mill-grip sleeve, an obvious advantage over systems employing an elusive key release. Any size drill will fit the chuck. This tool can be connected to a.c. or d.c. mains, four voltages being available. It is supplied complete with 9 ft of three-core cable. Price £15 5s. *Rawlplug Co., Rawlplug Hse, Cromwell Rd, S.W.7.*

Rawlplug 1 200 and 420 r.p.m. drill. £15 5s

New Bylock refrigerator

BYLOCK are now distributing a 4·6 cu ft continental refrigerator under the trade name "Centurion." This compressor model offers several popular luxury features, such as interior light, deep vegetable crisper, door compartments for butter and cheese, and full width freezer of 31 cu in. capacity. The long vertical door handle has a right-angled bend, allowing firm purchase by hand, wrist or elbow.

The first of a new range, Model 13 T, stands 33½ in. high by 24 in. wide by 22½ in. deep. It has the flat table top, which is on its way to becoming a universal feature of cabinets this size. "Centurion" costs £69 6s, including tax. *Bylock Electric Ltd., Enfield, Middx.*

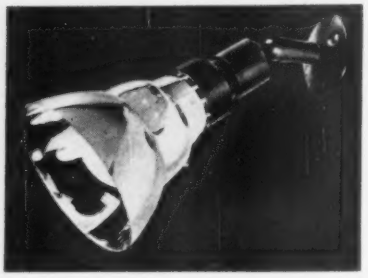
Post-Budget Hotpoint prices

HOTPOINT announced reductions of 5% to 10% in the list prices of their washing machines and refrigerators following the Budget. The "Princess" washing machine, heated, with wringer, is now £49 7s retail, a drop of £6 6s. Reductions of £5 5s and £3 3s have been made on the E.50 and E.37 table-top refrigerators. These models now cost £73 10s and £63 retail respectively.

Spotlights cost less

SUBSTANTIAL price reductions affecting SK spotlight fittings have been announced by Courtney Pope Ltd. These fittings, which have a 360° movement radius, now cost 16s (ES) and 12s 6d (BC), reductions of 3s and 2s 6d.

At the same time, the "Controlite" clip-on reflector, for use with the fittings, has been improved to incorporate a longer neck. New price is 15s 6d, whilst the short-neck model has been reduced to 13s 6d. Thus, even with the innovation, the complete fitting is considerably cheaper than before. *Courtney, Pope (Electrical) Ltd., Amhurst Pk Wks, Tottenham, N.15.*



TRADE PUBLICATIONS

S.T.C.—Two booklets on valves and one on bidirectional transistors from Standard Telephones and Cables Ltd., Footscray Rd, Sidcup, Kent.

HEDIN.—Looseleaf catalogue of heating equipment giving technical data sheet. Hedin Ltd., Commerce Estate, S Woodford.

ERICSSON.—Data sheets on miniature relay and miniature low noise-level chopper relay. Ericsson Telephones Ltd., Beeston, Notts.

Circuit-breaker prices

CHILTON Electric Products Ltd. have announced reductions in the prices of their "Protector" miniature circuit-breakers. The single-pole unit now costs 17s net trade, the triple pole from £4 17s 6d, net trade. These units were originally list priced at £1 8s 6d and £9 1s, respectively.

From 5 April all circuit-breaker price lists issued by this firm will contain net trade prices only. *Chilton Electric Products Ltd., Hungerford, Berks.*

Lights in a row

PENDANT light fittings that can be arranged in rows of two or more have been introduced into the CMC range. Angular, elongated glass shades are suspended between brass ceiling plates, the white plastic flexes forming an effective pattern of V's. Opal shades are of slim modern design with cut line decoration. 60 to 100 W lamps may be employed.

Two drops, involving three ceiling plates and four flexes, cost £7 10s 5d, six drops, £20 11s 8d. Additional drops can be added. *C. M. Churchouse Ltd., Clarendon Wks, Clarendon Cross, W.11.*

Parnall Spinwasher price

RETAIL price of the "Parnall Spinwasher" described on this page in 31 March issue should have read £78 15s for the unheated model.

Weatherproof ES lampholder

AN integrally moulded ES pendant lampholder suitable for open air application has recently been introduced. As well as the two-core flex, toughened rubber encases the holder, ending in a lip which conforms with the shape of an inserted lamp, to give an efficient weatherproof seal. The ES thread is carried on a nylon liner.

This holder incorporates 18 in. of flex though any other length may be supplied if required. Price of the model, No. R8521, is 6s 6d. A BC version, No. R6221 is also available. *D. R. Illuminations Ltd., Warren St, Stockport.*

ES Pendant lampholder integrally moulded, 6s 6d ▶

Long-necked "Controlite" with ◀ *SK fitting. About 30s*

equipment for industry

P.T.F.E. sleeving

TWENTY-SIX sizes of p.t.f.e. sleeving in a variety of ten fade-proof colours have recently become available. P.T.F.E. has good electrical properties and is noteworthy for its being unaffected by heat during soldering operations. The sleeving varies from bore diameters of 0·013 to 0·336 in. *Polypenco Ltd., 68 Tewin Rd, Welwyn Garden City, Herts.*

L.V. prod-tester

TO meet the requirements of electricians working on low voltage d.c. systems, especially on ring mains, a fixed prod-tester has recently been introduced suitable for the 24/100 V range. One of the prods is formed into the body of the tester, while the other is attached to a suitable length of lead. The prods have spring-loaded sheaths and include a 2 A h.r.c. fuse and 5 ohm current limiting resistor. The body of the tester is formed from high impact strength plastics and has a built-in magnifier to enable the indicator to be easily read. If inadvertently connected to an a.c. circuit, the tester gives warning by violent vibration and, on either a.c. or d.c. systems, the indicator disc will show if a higher range is required. *Martindale Electric Co. Ltd., Westmorland Rd, N.W.9.*

Meter with a memory

AS part of their twenty-first celebrations, Southern Instruments are planning to introduce 21 new products this year. In the van is a universal electronic memory meter, having an unusually wide measurement range. The meter incorporates a Tripole circuit and has an impedance said to approach 100 million megohms on voltage ranges, while on current ranges it is virtually zero. Voltage readings can be made in the range 0·5 to 2,000 V with extension to 1 millivolt and 35 kV by additional equipment. A storage device is included to permit voltage readings to be "memorised" for several hours by the meter, but with provision for erasure at will. The current range is said to read from 0·5 micro A to 2 mA and this also can be extended considerably. Capacitance and resistance measurements can be made, the latter for values as high as 1,000 megohm, or up to 100 billion ohms with a special attachment. *Southern Instruments Ltd., Frimley Rd, Camberley, Surrey.*

New AEI vacuum gauges

THE redesign of the well known Metrovac high vacuum gauges has just been completed by the Instrumentation Division of AEI (Manchester) and the new range includes Ionisation, Penning, Pirani and Thermocouple gauges covering the pressure range from 10^{-9} mm to 1 mm mercury. Gauge heads are small, robust and demountable. Metal cased, they have been designed so that wearing parts can be replaced at small cost. *Instrumentation Division, AEI (Manchester) Ltd., Mosley Rd Wks, Trafford Park, Manchester.*

Thermostatic controls

AMONG the exhibits on their stand at the Electrical Engineers' Exhibition, Honeywell Controls are showing four new items: three thermostats and a toggle switch. Thermostat type TA 42J is suitable for under-floor heating control. It will take up to 17 A and incorporates a positive on/off action to comply with IEE regulations. The attractive clock thermostat illustrated below automatically raises room temperature in the morning and lowers it at night. This is the model T 852. The final introduction is the TA 42 A which has a large surface area bellows for good sensitivity. The new toggle switch measures only ½ in. across, has wrap-round terminal posts and a d.p.d.t. action. *Honeywell Controls Ltd., Wadsworth Rd, Perivale, Middx.*

Small electromagnetic coupling

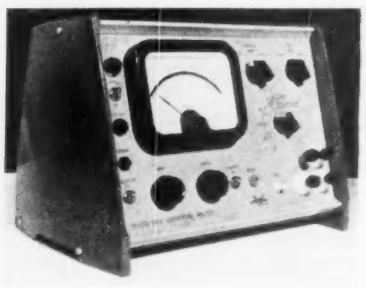
AN electromagnetic clutch coupling only 1¼ in. in dia. has now been added to the Warner range. To be known as model S.F. 100, it has been designed to transmit a torque of 2 lb in. and has a response time of a few milliseconds. The rating is given as 6 watts. The new clutch can achieve a maximum speed of 15,000 r.p.m. and is particularly suitable for control mechanisms on light instrument drives, computers and servo mechanisms. Automatic compensation for wear is a feature of the design. *Westool Ltd., St. Helens Auckland, Co. Durham.*

GEC s.c. motors range

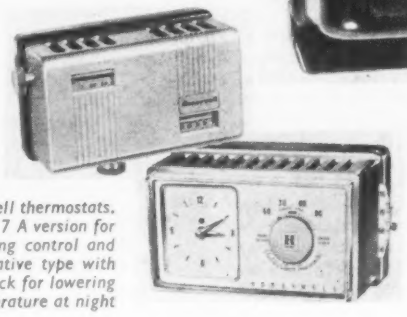
A NEW range of totally enclosed fan-cooled squirrel-cage motors with Class E insulation complying with Draft BS A(ELE)1629 has been announced by the General Electric Co. Sizes immediately available from stock range up to 7½ h.p. at 1,500 r.p.m. and up to 5 h.p. at 1,000 r.p.m. Others up to 40 h.p. will be available shortly. *The General Electric Co., Rotating Plant Division, Witton, Birmingham 6.*

Quiet contactor has long life

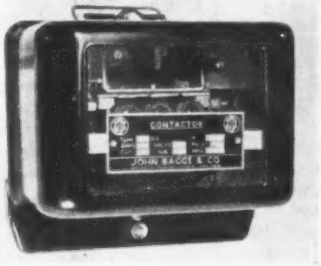
A LIFE far in excess of the conventional relay coupled with quiet operation is claimed for a range of high grade mercury switching contactors available in ratings up to 200 A at 440 V. The latest addition to the range is a 30 A t.p. and n. unit, housed in a moulded case similar to that used for electricity supply meters. A version is also available in the same case size for 60 A rating. These relays are said to be suitable for lighting and heating control where their intrinsically quiet operation, freedom from maintenance and long life are valuable assets. *John Baggs, Uppermill, Nr. Oldham, Lancs.*



◀ *The ERIC memory multimeter by Southern Instruments*



Two Honeywell thermostats. Above is a 17 A version for under floor heating control and below, an alternative type with an electric clock for lowering room temperature at night



A 30 A t.p. and n. mercury switch contactor suitable for heating and lighting control

Electrons in the Test Room

ELECTRONIC equipment for the test room continues to expand and improve and a new entrant to the field starts with a range of eight appliances which they claim to be competitive in price and without sacrifice of technical specification, reliability or finished appearance. The first of these is a general purpose oscilloscope with a 5 in. flat face screen incorporating gold-plated printed circuits with wide band amplifiers for TV servicing, F.M. alignment and other special applications. A patent sweep circuit covering the range from 10 c/s to 500 kc/s in five steps is claimed to be many times the usual range of other oscilloscopes. Dimensions are 8¾ in. by 14½ in. by 18 in. and the price is £44. The model number is 0-12U-F.

The Electronic Switch, model S-3U-F listed at 15 gn, is designed to be used as an oscilloscope trace doubler and will extend the application of a single beam oscilloscope to give simultaneous traces of two separate signals.

The Valve Voltmeter, model V-7A-F, listed at £19, is a general purpose instrument, also with gold-plated printed circuits, for laboratories, service workshops and amateur use with an extremely wide range of voltages, a.c. and d.c., and resistances.

The R.F. Probe, model 309-CU-F, at 33s is an accessory for the valve voltmeter to extend the frequency range to 100 Mc/s with a useful indication up to 300 Mc/s.

Other products include an audio valve millivoltmeter, a capacitance with four ranges extending from 100 picofarads to 0·1 microfarads, and an audio wattmeter. *Beulah Electronics, Direct TV Replacements, 138 Lewisham Way, London S.E.14.*

Gland Sizes Extended

OF Danish design and manufacture, the range of weatherproof nylon cable glands and lock nuts marketed by Elkay Electrical has now been extended to include 1 in. and 1¼ in. conduit thread sizes, having previously covered ¾ in. conduit and ⅜ in. and ½ B.S.P. sizes only. As those familiar with their use will recall, these glands are mounted in the shock-resisting nylon compound, "Grillon" which is stated to be capable of withstanding considerable rough usage and corrosion. Each gland comprises four parts—a body, rubber gland, metal washer and clamping bush; for use in metal sheet which is too thin to tap, nylon locknuts are used for securing the gland. Details from *Elkay Electrical Manufacturing Co. Ltd., 42 Woburn Pl, W.C.1.*

New Contactor is Compact

WELL in keeping with the modern demand for compactness, the new B20 block contactor just introduced by the Control Gear Division of GWB Furnaces provides a 20 amp current rating at 550 V in a cube of approximately $3\frac{7}{16}$ in. side. It is of the solenoid-operated, spring-return type, and may, therefore, be mounted and operated in any position. Its name derives from the block construction, in which a base plate carries the fixed and moving parts of the magnet system, these being superimposed by the fixed-contact block with the moving-contact block completing the vertical assembly. Both blocks are polyester mouldings, and carry main contacts of sintered silver-alloy and auxiliary contacts of silver. The latter are reversible, in that they may be speedily changed from normally closed to normally open. Movement of the armature is imparted to the moving-contact assembly by means of contact tappets, the separation of the contact assembly from the magnet system giving complete self-alignment. Price of a t.p. unit with two auxiliary contacts is £3 15s, from *GWB Furnaces Ltd., PO Box No. 4, Dibdale Works, Dudley, Worcs.*

NEW LUMINOUS CEILING

POPULARITY of luminous ceilings has snowballed in the last two or three years, if reflected only by the variety of designs available. Latest to appear on the market comes from Lumitron Ltd., who have just developed a prefabricated suspended luminous ceiling which is capable of carrying circuit wiring. This feature, coupled with ease of erection, ensures that, in most cases, installation is within the competence of the electrical contract.

The basis of the ceiling is the inverted T-section track which supports the corrugated vinyl strip, or opal pans, used as the light diffusing medium. The section is novel in that the "leg" of the T is a channel approximately ½ in. wide having the dual function of housing cables and securing the support fixing. This latter takes the form of a specially shaped nut which is slipped into grooves on the inside surfaces of the channel and locked into place by simply twisting it with a coin.

The track is suspended from the ceiling by means of down hangers of 1 in. square, box-section aluminium tubing, which are secured to the ceiling and to the track by means of angle brackets. These are secured to the ceiling by normal masonry fixing methods and to the track through the agency of bolts engaging with the special nuts. The fixing holes in the brackets are slotted, so that the suspension may be adjusted up to a maximum of ¼ in. in any required direction.

Tracks are suspended at 36 in. centres, to support the 35 in. wide corrugated strip or 34½ in. square pans. Where the latter are used, transverse lengths of track are fitted between the main runs to form the required square. The ceiling may be installed to give wall-to-wall coverage for overall illumination, or specific areas only need be installed for a more local lighting effect.

Normally, of course, fluorescent lamps are used as the lighting medium, batten fittings (or designs equally simple) being mounted direct to the ceiling or suspended from it by any of the recognised means. It is also possible to fix cross hangers between the down hangers to provide off-ceiling mountings for the fittings if desired. Supplementary lighting, in the form of spotlighting fittings may be mounted from the ceiling, either as flush units in hardboard panels carried on the tracks or as surface units attached to the underside of the 2¾ in. wide flange of the track, their circuit wiring being carried in the framework.

Lumitron illuminated ceiling contains circuit wiring and is simply constructed

Electric wheelpower

ALTHOUGH electric traction has found little application in road vehicles outside battery-powered trucks and delivery vans, a new development from International General Electric, in the form of a "self-powered" wheel, may well extend its use considerably in large cross-country vehicles, of the type employed on open-cast mining, highway construction and logging. Developed by the firm's Locomotive and Car Equipment Department, the wheel is completely self-contained and requires only connection to an electricity supply.

As shown in the accompanying illustration, the hub contains an electric traction motor, which drives the wheel rim through gearing. Each wheel is capable of developing 380 h.p. at the rim, giving a total of 1,520 h.p. for a vehicle fitted with four such wheels. Power for the wheel would, in most cases, be supplied from a diesel-generator set, although it would be equally possible, where convenient, to supply the vehicle from o.h. wires.

One of the chief advantages of this method of traction is substantially greater manoeuvrability; a 125 ton gross weight hauler is stated to have the manoeuvrability of a vehicle one-third its size. There is an associated advantage in that if one of the motorised wheels should loose its grip in mud or snow, the generator power available is automatically transferred to those wheels having good purchase.

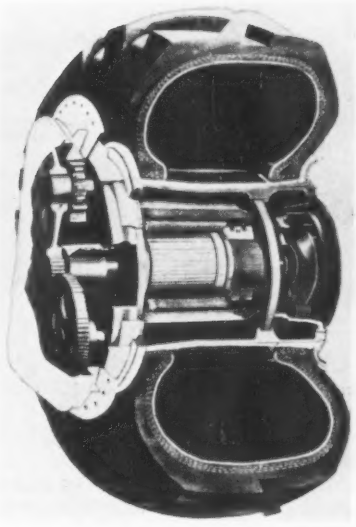
Other advantages of diesel-electric traction are that full engine power output is available for tractive effort over the entire speed range and engine stalling on momentary overloads is virtually eliminated. A tractive effort three times the rated value can be applied for one minute if necessary. Performance on gradients of 1 in 10 or steeper is also considerably better than that of conventional vehicles of equivalent horsepower. Trolley-powered vehicles are proposed for 1 in 6½ gradients, at speeds in excess of 10 m.p.h.

The opportunity provided by electric traction to employ dynamic braking means that improved braking performance is also obtained. Travelling at its maximum speed of 35 m.p.h., a motorised-wheel vehicle can bring itself to a stop within three times its own length. The improved braking performance means better utilisation of the vehicle, since it can be operated with safety at higher speeds than with conventional vehicles.

As an example of these advantages, a prototype motorised-wheel vehicle of 55 ton weight and a load capacity also of 55 ton, was designed for carrying iron ore. It was capable of handling gradients of 1 in 6½ fully loaded and could turn in only a few feet more than its own length.

Elimination of mechanical transmission also reduces maintenance costs, and still further improves vehicle utilisation, by giving more maintenance-free working days. Overall efficiency is also greater than that of equivalent conventional vehicles, in view of the elimination of friction associated with mechanical transmission.

Moreover, since the designer is not limited by the necessity to allow for drive shafts, rear axles, and other mechanical transmission components, special vehicles may be developed for specific duties and motorised wheels may be placed exactly where they will function to the best mechanical advantage. Since the capacity of a single vehicle utilising the motorised wheels is greater than that of a conventional haulage vehicle, fewer trucks will be needed, thus saving in capital expenditure.



Haulage wheel with built-in electric driving motor, develops 380 h.p. Dispensing with mechanical transmission is claimed to make it more efficient than conventional drives

BRITISH STANDARDS

Fixed ceramic-dielectric capacitors, Grade 1. Part 1: General requirements and tests. *BS 2133A : Pt. 1 : 1960. Price 12s 6d.* Published as part of the series of standards for components used in telecommunication and allied electronic equipment, this new document is concerned with Grade 1, fixed capacitors having a ceramic dielectric, which are suitable for use in tuned circuits or in any other application where low loss and stability of capacitance are essential requirements. The standard includes tests for mechanical robustness, durability and ability to withstand specified climatic conditions; it also specifies a colour code for indicating value, tolerance and temperature coefficient.

Plugs and locking sockets for electric battery vehicles and trucks. *BS 3214 : 1960. Price 4s 6d.* When BS 74, *Charging plugs and sockets for electric battery vehicles* was issued in 1949, it met the needs of industry for standardized fittings up to 150 amp rating. A requirement has now arisen for fittings of 300 amps, not only for charging but also for main traction current duties, and it is with this in mind that the present specification has been prepared. The new standard covers a 300 ampere rating, at a maximum of 125V. However, under normal service conditions, the fittings are used at extra-low voltage, not exceeding 30V a.c. or 50V d.c. and no earthing connection is required. Sections of the standard give both general requirements and details of the construction of the plug and locking socket. There is also a section laying down high voltage (routine), temperature rise, mechanical drop and contact pressure tests, and nine figures illustrating the construction and operation of the plugs and sockets, with the dimensions necessary to ensure interchangeability.

Interference characteristics and performance of radio receiving equipment for aural and visual reproduction. *BS 905 : 1959. Price 12s 6d.* The problem of interference in radio and television receivers has two aspects; first, the liability to produce mains-borne interference by domestic or industrial appliances which will affect the purity or clarity of reproduction; secondly, the susceptibility of a receiver to mains-borne interference with additional consideration of its liability to produce mains- or airborne-interference in other receivers in the vicinity. This specification, an up-to-date revision of the first issue in 1940, deals with the second aspect and is of interest mainly to radio and television receiver manufacturers. There is little in it which concerns the manufacturer or user of other electrical appliances or machinery in his efforts to avoid creating interference.

Photographic electronic flash equipment. *BS 3205:1960. Price 4s 6d.* With the object of specifying the constructional requirements and tests necessary to ensure satisfactory and safe operation of photographic electronic flash equipment, this new standard indicates the essential data required in order to test and evaluate performance. It does not, however, specify a standard of performance of complete apparatus. It gives main constructional requirements without going into details of design. An appendix gives notes on the calculation of exposure and relationship between the specified performance of the equipment and the exposures required.

News of the Week

GOVERNMENT ECONOMIC SURVEY CALLS FOR INCREASED EXPORTS

Outlook for U.K. "reasonably favourable"

AN even larger increase in volume of exports during 1960 than was achieved in 1959 is called for in the Government's Economic Survey for 1960. Such an increase will be possible only if UK export prices are competitive, if home demand does not hold back exports, and if firms in the UK take full advantage of favourable world conditions.

That is the leading conclusion of the survey which provides a background to the budget proposals introduced on Monday by the Chancellor of the Exchequer. The increase in the value of imports from 1958-59 was 6½%, against an increase of 5% in value of exports.

The survey forecasts that in industrial countries of the world, expansion will continue in 1960, although not as rapidly as in 1959. On the whole, the world prospect is considered "reasonably favourable" for the UK. Substantial reductions in import restrictions by several countries in 1959 are expected to help in this connection. At home, forecasts of private and public investment suggest that taken together, total fixed investment demand will rise at least as fast in 1960 as it did in 1959. Personal consumption, however, may rise less.

1960 should see a small increase in the labour force, and there should be scope for a larger increase in output per head than the average in the past decade. A concluding factor here is the lengthening order books of some industries. The survey warns that as the year proceeds it may become increasingly difficult to increase employment, particularly of skilled labour in some areas. This situation underlines the need to train more skilled workers.

Outlook for costs in 1960 is thought to be uncertain, so much depends on the outcome of wage negotiations.

The survey looks backwards as well as forwards; most of its 64 pages are concerned with last year. 1959 saw industrial production running 17% higher in its last quarter than the average for 1954. Recovery began in industries producing durable consumer goods and spread only gradually to other industries.

Output from the engineering and allied industries as a whole was 6½% higher in 1959 than in 1958 and provided two-fifths of the total increase in production.

Taking industry as a whole, output per man year increased from 109 in the fourth quarter of 1958 to 118 in the fourth quarter of 1959 (on a basis of 1954 average equal 100).

Budget Proposals

The Budget proposals made no major alterations affecting the electrical industry. In the course of his speech, however, the Chancellor announced that he would be seeking powers to extend for three years from next August the right of the Treasury to lend directly to the electricity supply and other nationalised industries.

One other change affects electrically operated lighters; these are to be liable to the same Customs and Excise duties as mechanically operated lighters.

Telcon Metals formed

A NEW company, Telcon Metals Ltd., has been formed by BICC to assume responsibility for all the activities of the Metals Division of the Telegraph Construction and Maintenance Co. Ltd., including the manufacture of Telcon magnetic materials and other special alloys used in the electrical and engineering industries, and the metallurgical operations associated therewith.

Telcon Metals will operate the factory at Crawley and will control the following subsidiaries: Magnetic and Electrical Alloys Ltd., Telcon-Magnetic Cores Ltd., Temco Ltd., Toolpro Ltd.

On the board of the new company are: W. C. Handley (chairman), W. F. Randall (deputy chairman and managing director), G. A. V. Sowter (commercial director), H. H. Scholefield (technical director) and D. Norman-Thomas. Mr L. D. Dodd is secretary.

Simms' Acquisition

THE Simms Motor and Electronics Corporation has acquired for cash all the issued capital of Cawkell Research and Electronics Ltd., thus adding electronic instrumentation to its existing interests in the electronics field.

Tax concession on lighting battens

A WELCOME purchase tax concession on fluorescent lighting battens when sold with attachments in kit form has resulted from talks between the Electric Light Fittings Association and the Board of Customs and Excise.

The position formerly was that, although plain batten fittings sold as separate articles were exempt from tax, when supplied with attachments and kits in themselves chargeable with tax, the battens were regarded as forming part of a complete taxable fitting carrying the prescribed purchase tax of 25%.

The Board of Customs and Excise have now agreed that, subject to certain conditions, the tax charge is to be regarded as extending only to the attachments or kits and not to the battens. The conditions to be satisfied are:

The batten fitting must be designed for use as a separate batten fitting, and be freely available as such.

Where the attachment is supplied in kit form the whole of its components must be included in the kit.

The attachment (or kit) must be complete in itself as an attachment for a batten fitting, and must be separately packed, priced, invoiced and advertised from the batten fitting. Attachment and batten may be illustrated in association with each other, but must be catalogued and priced as separate articles.

The concession applies only to batten fittings and not to other kinds of fluorescent lighting fittings (e.g., recessed fittings or trough reflectors), nor to filament lamp fittings of any kind. Manufacturers or traders wishing to take advantage of this facility should consult their Purchase Tax Officer about the arrangement of any new price lists or catalogues.

EXCESSIVE APPLIANCE PRODUCTION CAPACITY?

THE manufacturing capacity now being applied in the domestic appliance field is becoming excessive in some product ranges and is grossly excessive in others—that is the view of Mr Hugh P. Barker, M.I.MECH.E., M.I.E.E., M.INST.GAS E., M.INST.T., *chairman of Parkinson Cowan Ltd. "A number of companies who have yet to experience this capricious industry are entering the fringe of the market in a rush reminiscent of the radio boom in the 1920's. That boom ended in long profitless operation for the whole industry, and the eventual emergence of only a small number of the fittest and most powerful participants," he adds. There is no doubt that the market for domestic appliances will continue to grow, but he thinks the industry is acting too precipitately. He remains quietly confident of his own group's prospects.*

Production Expanding

PRODUCTION of electrical and engineering goods in January was 15% up on the same month last year, according to estimates by the Board of Trade.

During 1959, output of the electrical and engineering industries increased steadily. In the first six months production was 8%, in the third quarter 18%, and in the fourth quarter 13% higher than in the corresponding periods of 1958. In the early part of the year the increase was mainly attributable to the notable rise in production of consumer goods, but in the second half of the year, increasing output of capital goods began to contribute to the overall gain.

Deliveries of electrical engineering products showed small increases, apart from domestic appliances which advanced by some 40% to the 1959 total of £145·9 million from £103·5 million in 1958.

Denmark restricts imports

DENMARK last month introduced revised arrangements for quantitative import restrictions on various goods. Among the electrical equipment included are: washing machines, generators (up to 4 MW), motors, converters (rotary or static), transformers of over 1,200 kVA, rectifiers, accumulators, except alkaline and parts of accumulators, water heaters, immersion heaters, cookers and refrigerating cupboards up to 200 litres. Goods not on the list may be freely imported from OEEC countries and the dollar area.

Switchgear and Instrumentation Ltd. have recently moved into new premises at Littlemoor Works, Pudsey, Yorks, occupying one-third of an acre and equipped for the manufacture of control and instrument panels. Picture shows a corner of the works and indicates the spacious layout with well planned lighting

Regulations for Nuclear Safety

THE Nuclear Installations Act came into force on 1 April, 1960. One of its provisions covers the action to be taken if a dangerous occurrence happens on a site licensed under the Act. Regulations on this point have been made jointly by the Minister of Power and the Secretary of State for Scotland and are now before Parliament. They specify the classes of occurrences which must be reported, to whom they are to be reported and the way in which this is to be done.

Nuclear installations already operating, which will require a licence under the Act on 1 April are two in number, both research reactors of private firms. (The Act does not require installations of the UKAEA to be licensed). The other licences coming into force on 1 April will be those relating to the construction of the first five nuclear power stations of the electricity boards.

The new regulations are concerned with injury or damage caused or likely to be caused by any emission of ionising radiations or by radioactive or toxic substances. The incidents reportable under the regulations are therefore restricted to those likely to give rise to risks of this kind. They are not, however, restricted only to occurrences happening on the site; they include also incidents arising from the disposal of waste or the transport of irradiated fuel elements.

Incidents liable to have effects beyond the confines of the site are to be reported to the Minister (in Scotland the Secretary of State), the police and the local authority, because it is essential that they should be informed of all such cases. Emergency schemes to be approved by the Minister or the Secretary of State for every licensed site will, however, be made to ensure that other authorities or bodies liable to be affected by occurrences at that particular installation are promptly informed. Occurrences of which the effect is confined to the site will be reported to the Minister or Secretary of State only.

SUPPLY INDUSTRY INVESTMENT

ESTIMATES prepared by the CEGB and the area boards for investment in the financial year 1960-61 are being revised upwards. This is stated in the White Paper on "Capital Investment in the Coal, Electricity and Gas Industries," published this week. The figures given in the table below relate to existing plans approved by the Minister.

Since these were considered and approved (in August last) the CEGB has reached the conclusion that expenditure on existing contracts is likely to be higher than had been expected, largely because of faster progress with nuclear stations than had been expected, and partly due to similar acceleration with the building of conventional stations. Area boards have stepped up their estimates because the rapid expansion in the economy of the country last year has necessitated a revision of plans for extending and reinforcing distribution systems. Revised programmes are currently before the Minister of Power.

Electricity Council and Board spending exceeded estimates in 1959-60 by £4·7 million, also because of faster work on power stations, but there was £2·5 million less spending on fuel than had been estimated. Both the Scottish boards underspent slightly on estimates during the year reviewed, however.

Capital Expenditure Estimates for Supply Industry

		Generation £m	Main Transmission £m	Distribution £m	Total £m
El. Council and Boards	1959/60	178·5	34·0	95·7	308·2*
	1960/61	153·5	31·0	90·9	275·4*
N of S H.E.B. ...	1959	8·8	1·5	2·7	13·0
	1960	9·5	1·7	3·5	14·7
S of S E.B. ...	1959	16·6	2·5	7·7	27·4†
	1960	14·2	3·0	7·9	26·0†

*Current estimates being revised upwards. In 1959/60 an additional £6·4m was spent on nuclear fuel, and the estimate for 1960/61 (not included above) is £9·6m.
†Includes "other" expenditure, £0·6m for 1959, £0·9m for 1960.

Electrical Engineers' Show opens

A $1 million order—one of the largest placed for domestic equipment—was booked shortly after the opening of the Electrical Engineers' Exhibition at Earls Court on Tuesday. Gatehill (Beco) Ltd. booked the order from Jack Dubov Assoc. Inc. of New York. It is for 75,000 infra-red heaters to be supplied over the next three years, plus industrial models.

Winners of the two awards—silver plaques—at the Exhibition are Brunt Variable Speed Motors Ltd. (for their range of v.s. motors) and Heatrae Ltd. (for their "Lidomatic" under-sink water heater system).

At the official opening, the Rt Hon Reginald Maudling, President of the Board of Trade, after welcoming visitors from the Commonwealth and Outer Seven countries, as well as from elsewhere, referred to the keen competition in Scandinavian markets which he noted during his visit there.

Education for Management

RADICAL changes are to be made in the present schemes of management studies and commerce, the Minister of Education announced last week in a circular to local education authorities. The new scheme, which has been agreed with the British Institute of Management and other bodies concerned, makes provision for :

A new diploma in management studies—will be awarded (not before the age of 26) to students who have completed a course of study which may be full time (one year) or part time (three years) or a mixture of the two. Before starting the course, students will normally be required to hold a degree, Diploma in Technology or equivalent professional qualification, but arrangements will also be made to enable older students without these qualifications, but with substantial practical experience, to take a diploma course.

UK Advisory Council—to be appointed by the Minister of Education, Secretary of State for Scotland and the Minister of Education for Northern Ireland. The Council will keep under review the provision for management education in technical colleges, and maintain contact with other bodies providing management education, giving advice on request.

National certificates in business studies—two new national certificates, one at higher level and one at lower level, will provide a basis for the growth of part time courses. The existing Intermediate Certificate in Management Studies and the Higher National Certificate in Commerce will be merged, and the Ordinary National Certificate and the Intermediate examinations of professional bodies in the commercial field will be linked by exemptions.

These changes are designed to give management education its rightful place as an advanced study appropriate for graduates and professionally qualified men and women who also have a background of practical experience in industry.

New TV Company

TO deal with the increasing world-wide demand for television stations, studios, cameras and transmission equipment, Pye have formed a new company called Pye TVT Ltd. The company will take over the functions of the group's television transmission division and expand its activities in the fields of industrial television, atomics and other specialised applications of television.

Directors of Pye TVT are: C. A. W. Harmer, the Hon R. N. Frankland, N. A. Twemlow, L. W. Jones and T. G. MacLagan. In addition, there is a board of executive directors comprising A. J. Bennett, L. W. Germany, D. Jackson, E. C. Milton, F. R. Shelton and A. R. Stone.

Trade with Bulgaria

ELECTRICAL equipment is included in the quota list of goods which the UK will import from Bulgaria during the 12 months ending 31 March, 1961. Out of a total of £3·9 million allowed for imports of Bulgarian goods, £95,000 will cover electric motors (over 1 kW), power transformers (over 50 kW), accumulators, plastic insulating products, porcelain insulators, conduit tubing and installation fittings.

At the same time Britain will export to Bulgaria £6·3 million worth of goods, including machinery, radio, television and telegraph communication equipment, under a reciprocal trade arrangement.

Eire's Accessories Duty

A WIDE range of electrical accessories, except those made wholly or mainly of metal, are covered by a new Imposition of Duties Order made by the Irish Republic Revenue Commissioners. Under this, the full rate of duty is 75% *ad valorem*, and the UK and Canada preferential rate is 50% *ad valorem*.

The items covered are: tumbler switches and rocker dolly switches of not less than 1 in. dia, switch plates and covers, socket-outlet (excluding those with metal plates), plug tops (without switches), b.c. lampholder plugs, iron and kettle connectors, ceiling roses (except those with a switch), b.c. lampholders, junction boxes up to 4 in. dia and six terminals, and plug adaptors. In addition, component parts of switches, sockets, plugs, ceiling roses, lampholders and junction boxes are also included in the provisions.

E.C.A. joins B.L.C.

THE Electrical Contractors Association has become a member of the British Lighting Council as from 1 April, and Mr L. C. Penwill, director and secretary of the ECA will represent that organisation on BLC's Council of Management and Executive Committee.

Other members of the BLC include the British Electrical Development Association, the Electric Lamp Industry Council, and the Lighting Equipment Development Council.

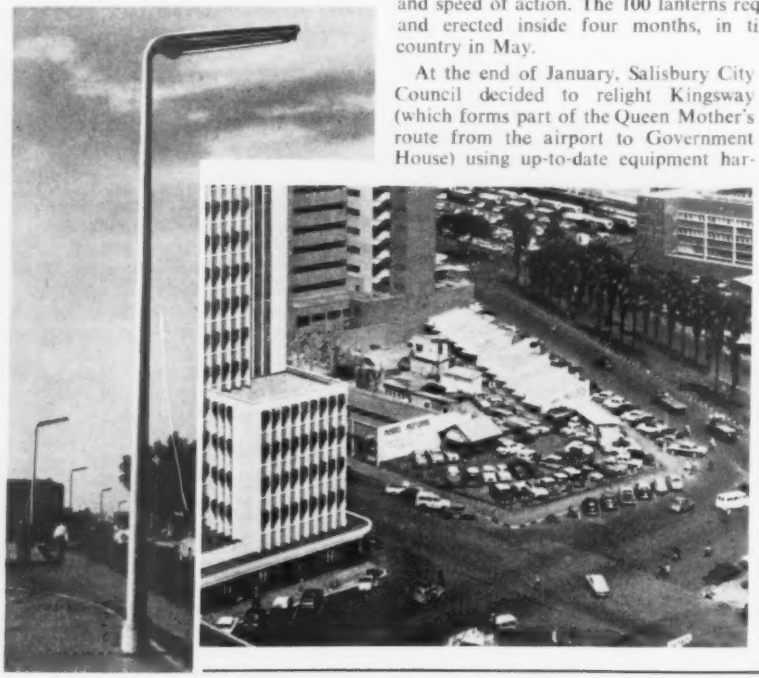
Royal lighting at the double

A NEW street lighting installation along Kingsway, Salisbury, one of the Southern Rhodesian capital's main thoroughfares, is a tribute to British engineering design and speed of action. The 100 lanterns required will have been ordered, made, shipped and erected inside four months, in time for the Queen Mother's visit to the country in May.

At the end of January, Salisbury City Council decided to relight Kingsway (which forms part of the Queen Mother's route from the airport to Government House) using up-to-date equipment harmonising with its surroundings. Choice fell on the Siemens-Ediswan Kuwait lantern, whose lines form an architectural unity with its mounting column.

For the lighting to be installed and working by May 11, the lanterns were required in Salisbury by early April. AEI Export were cabled, and orders immediately placed with the works at Spennymoor, Co. Durham. Such was the original design of the lantern, that the desired 5 ft, four-lamp units could be assembled straight away, against a given code number, using components already made.

The order was completed and at the London Docks by 26 Feb., shipped on to the *Auckland Star*, which sailed on 6 March, taking only 15 days to Cape Town, from which they were sent by rail to arrive in Salisbury by April 4, in good time for erection.



Picture shows (left) the Siemens Ediswan Kuwait lantern with column, and (right) a view of Salisbury with tree-lined Kingsway to the right, where AEI are supplying 100 lanterns to illuminate the dual carriageway in time for the Queen Mother's visit in May

Industrial Lighting in Birmingham

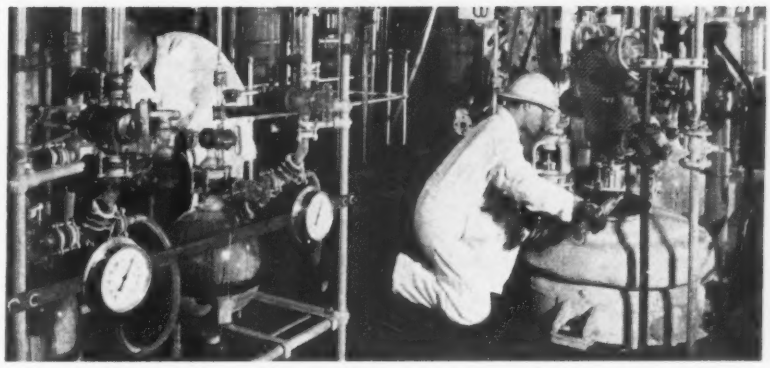
FOR works and production managers and engineers, the Birmingham Centre of the Illuminating Engineering Society is organising a one-day conference on industrial lighting on 21 April at the College of Technology, Gosta Green, Birmingham.

Following the opening at 10 a.m. by Mr A. B. E. Lovett, M.Sc., HM Superintending Inspector of Factories for the Birmingham area, there are to be four papers: "The Technical Basis of Good Lighting," by W. E. Harper; "Light Sources and Equipment," by H. R. Ruff; "Maintenance and Economics," by W. Robinson; "Some Recent Installations and Particular Problems," by J. G. Holmes.

A forum will provide opportunity for dealing with questions or problems. Applications (with £2 fee) to the secretary, IES Industrial Lighting Conference, 91 Brandwood Rd, Birmingham 14.

£300,000 Russian Order

HIGH voltage testing equipment worth more than £300,000 is to be supplied to the USSR by Ferranti Ltd. The order calls for two d.c. testing equipments (one giving an output of 2 MV), six a.c. testing equipments (including one with a rating of 3 MVA at 1½ MV and another of 4½ MVA at 750 kV), one 3·6 MV impulse generator, and other smaller items. The contract was negotiated through v/o Machino-import of Moscow.



A section of the new £½ million pilot plant in the product and process development department of the Barry factory of Midland Silicones Ltd. The plant is designed to try laboratory processes on an intermediate scale before embarking on full production. Midland Silicones, which celebrates its tenth anniversary this year, is a member of the Albright and Wilson group.

STEPPING ON THE GAS

IN an intensive nine-week sales drive to meet increasing competition from electricity and solid fuels, the North Western Gas Board sold a record 40,799 cookers, worth £1½ million, to consumers in Lancashire and Cheshire. Commission and cutting red tape were two of the factors contributing to this achievement.

In addition to the board's salesmen, commission is paid to any employee introducing a successful "sales prospect." One maintenance worker notched 95 such customers during the nine-week selling period.

To enable them to concentrate on their primary task of selling, salesmen have been freed as far as possible from administrative duties, form filling, etc. Training has played a big part, too: the board claim that their intensive courses in salesmanship recently introduced for all directly or indirectly concerned with sales are now beginning to show results.

The number of cookers sold in the nine weeks is nearly half the total number sold during the last working year, and 26% up on the same period in 1959.

Electric Vehicles in Industry

TWO out of every three vehicles used for internal transport in large electrical manufacturers' works are battery-operated, according to a recent survey by the Electric Vehicle Association of Gt. Britain Ltd. The use of battery-electric vehicles is increasing, for reasons, it is suggested, of efficiency and economy.

Other advantages mentioned by the firms surveyed include: absence of fumes, dust and noise when used inside buildings; lower fire risk; less possibility of accident due to controlled speed and simplicity of driving. One user of battery vehicles claimed a 70% reduction in running and maintenance costs since changing from petrol engined vehicles.

Careers Masters meet

CAREERS and science masters representing schools in all parts of the UK are guests of the CEGB this week at the Public School Careers Masters' Convention (held twice a year), comprising a series of talks on the generation and transmission of electricity and visits to a nuclear power site, a power station, the National Grid Control Centre and research laboratories.

UNLIT HOLE . . . *whose responsibility?*

A CLAIM against Mr S. Harrop, the chief constructional engineer of the East Midlands Electricity Board concerning a hole in a footpath alleged to have been insufficiently lit, was dismissed by the Melton magistrates last week. It was stated that a ten-year-old boy had fallen into the hole which was full of water. The hole had been dug and left by the board's workmen and Harrop, although he did not see the hole until after the accident, was nominally responsible for work carried out by these workmen, it was claimed.

At the initial hearing it was submitted that although Mr Harrop was nominally responsible for such jobs, he could not be held criminally responsible. Why, it was asked, had they only gone halfway up the ladder of responsibility?

At last week's hearing, Inspector T. Oliver pointed out that the prosecution was brought against Harrop because when interviewed he admitted it was his responsibility to see that the hole was lit. Dismissing the claim, the magistrates rejected a plea for Harrop's costs.

Offices Bill progresses

THE Offices Bill, which is to come into operation in January 1962, will not be an easy measure to implement, the Joint Under-Secretary of State for the Home Department, Mr Dennis Vosper, stated in the House of Commons last week when the Bill was read for the third time and passed. The Bill sets out to provide minimum standard of conditions of employment for office staff, including provisions for adequate lighting, heating and ventilation, and the regular inspection and maintenance of electrical equipment.

The necessary regulations would be laid after the Bill became law, Mr Vosper said, but the Government would still require further information from local authorities, and would consult with the various interests concerned. As to the future, the Government were considering whether the Bill should be overtaken by more comprehensive legislation.

Meanwhile, employers could do a great deal between now and 1962 towards implementing the intention of the Bill so that "when enforcement does come, there may not be so much to do."

Pyrotenax down under

PYROTENAX have increased their 50% holding in an Australian associated company, Pyrotenax (Holdings) Pty, by purchasing a further 36% of the £A50,000 capital.

Developing the Undeveloped

BRITAIN'S responsibilities in the economic development of the less developed areas of the world were debated last week during the second reading of the International Development Association Bill in the House of Commons. The main provision of the Bill concerns the payment of the UK's subscription to the Association, totalling £47 million over a period of years.

The association's aim is to promote economic development in the underdeveloped areas of the world, in particular, by providing finance on terms which are more flexible and bear less heavily on the balance of payments than those of conventional loans. This would further the objectives and supplement the activities of the International Bank, of which the new association is essentially an affiliate. Electricity generation and distribution schemes have been one of the most frequent objects of the Bank's loans.

The International Bank, which replenishes its funds by borrowing from the world's capital market, is not in itself designed to sponsor development in backward countries which may be unable to afford loans on commercial terms. For approved projects in underdeveloped areas the association, financed by Governments, will be empowered to lend on special terms, with a long period of repayment or, perhaps, a period of grace before repayment starts, or even, in some cases, a waiver of interest for an initial period.

LINE BY ROCKET

THE last major obstacle in the erection of a 275 kV line from Harker, near Carlisle, to Penwortham was overcome recently when a ship-to-shore rocket line was fired across the River Lune near the Crook o' Lune beauty spot. At the spot where the new cables cross the Lune the river flows through a deep gorge. Distance between the pylons on opposite banks is about 1,000 ft. The rocket firing was a complete success, the line landing close to the pylon on the north bank.

Completion of the 275 kV line had already been delayed by the action of two farmers who refused to allow the CEGB's workmen going on to their land—and in Lancaster County Court last February, the board were granted £650 damages against them.

Proposed B.S. for Pipe Hangers

THE traditional rod-type pipe hanger is met with in many variations on the same theme. This situation has arisen because no dimensional standard has existed to give guidance to the would-be user. The Engineering Equipment Users' Association has recently studied this problem and has now submitted to the British Standards Institution a document to be used as a basis for a draft British Standard for the dimensional standardisation of rod-type pipe hangers, suitable for use with mild steel and cast iron pipes, both insulated and uninsulated.

Much benefit could accrue from the publication of a British Standard on this subject, as it would enable manufacturers to market ranges of standardised components which will be acceptable to all sides of industry.

Drawback Duty Query

APPLICATIONS for the allowance of drawback duty on parts or accessories for use with thermostats for re-export, and also on parts (including switches and lampholders) for bottle lamp adaptors, have been received by the Board of Trade. Representations from interested parties should be sent to the BoT Tariff and Import Division, Horse Guards Ave, S.W.1, not later than 29 April next.

Pumped storage for N. Ireland?

THE possibility of a hydro-electric pumped-storage scheme for Northern Ireland is indicated in the latest move by the Ministry of Commerce. They have asked the Belfast Water Commissioners to consider a proposal that the Silent Valley reservoir should be utilised for such a scheme. If the Water Board approve the plan it would involve the use of Lough Shannah, a mountain lake, 800 ft above the Silent Valley reservoir.

It is understood that the NI Joint Electricity Committee which advises the Ministry on the best means of providing additional generating capacity, is also considering the Cavehill area of Belfast as a possible site for a second pumped storage scheme, utilising sea water from Belfast Lough.

Thompson Film Show

HRH The Duke of Edinburgh was principal guest at a film show and cocktail party given by John Thompson Ltd. at Grosvenor Hse, W.1, yesterday (6 April). Members of the Government, peers, MP's, and ambassadors were also among the 250 guests. Sir Edward Thompson, chairman and joint managing director of the company, presented to the Duke the John Thompson engineers who have been engaged on nuclear power projects.

Supporting the film show, which featured the activities of the group in the building of Dounreay and Berkeley nuclear power stations, was a photographic display showing applications of John Thompson steam-raising plant and other industrial equipment.

Call for National Consumer Centre

A NATIONAL consumer centre, publicly financed, to safeguard the interests of consumers, is recommended by Miss Elaine Burton, former Labour Member for Coventry South, in a report submitted last week to the Molony Committee. The centre would absorb existing bodies concerned with consumer protection, and be answerable to a Minister, such as the Lord President of the Council or the President of the Board of Trade.

The national consumer centre would receive complaints from the public about goods bought and sold in shops, and would initiate prosecutions where necessary. It would advise the Government on further measures of consumer protection, including the introduction of quality standards or graded "Kitemarks" by BSI, and operate an impartial testing service, publicising the results to a mass audience, perhaps through a weekly or monthly journal on sale at bookstalls.

Canadian Appliance Prospects in the U.K.

AN expanding and largely untapped market for domestic appliances and other semi-luxury goods is available to Canadian manufacturers in "booming Britain" and the continent of Europe, Mr James S. Duncan, chairman of the Dollar Sterling Trade Council and chairman of the Hydro-Electric Power Commission of Ontario, stated in Toronto last week. Canadian manufacturers have "an edge in the Commonwealth preferential tariff."

Spending on durable consumer goods in recent years has risen much faster in the UK than in Canada, he pointed out, although the level is lower. Average Canadian spending is 12% of the household budget, and this figure has remained consistent throughout the 1950's. But in Britain spending on consumer durables has risen steadily from 5% in 1950 to over 8% in 1959, and the trend is higher and faster.

Only 15% of all British households have a refrigerator, compared with 89% in Canada and 98% in the USA. Just over a third have a washing machine, whereas 86% of Canadian and 93% of US households own one. Clothes dryers have found their way into only three out of every 100 British households, compared with 13% in Canada and 18% in the USA.

OFFICIAL PUBLICATIONS

Radio Research, 1958. Report of the Department of Scientific and Industrial Research. HMSO. 3s 6d.

Nuclear Installations (Dangerous Occurrences) Regulations, 1960. SI No. 514 (see page 585).

Economic Survey, 1960. HMSO. 3s (see page 584).

Capital Investment in the Coal, Electricity and Gas Industries. HMSO, 6d (see page 585).

CUSHY FOOT

Cushioning in all three planes

The great success of Cushyfoot anti-vibration mountings is due to a unique combination of features.

With different degrees of flexibility in vertical, transverse and longitudinal directions, they can be arranged to give exactly the right amount of cushioning in every plane.

The very high deflections available isolate low frequency vibration and reduce foundation costs for large machines by obviating inertia blocks of concrete, or permitting the use of much smaller blocks. Bolting down is not necessary when friction locating pads are used in conjunction with the mountings.

For unit loads up to 3,500 lb., the Cushyfoot is compact, robust and designed so that the rubber elements never lose their resiliency and are protected from oil and mechanical damage.

Please write for brochure illustrating the application of Cushyfoot mountings to diesel generators, power presses, screens, compressors and many other machines causing vibration or requiring protection from it.

METALASTIK

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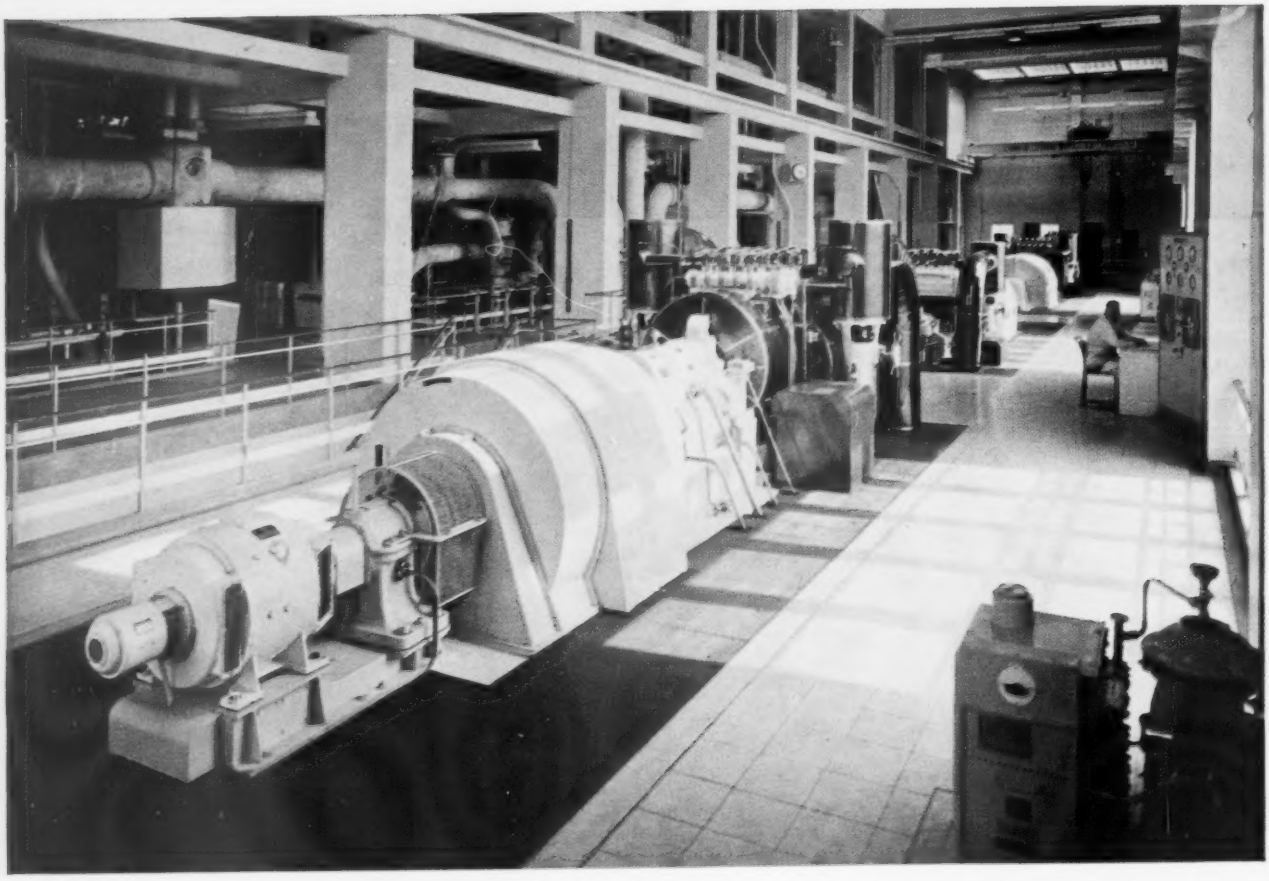
Power from Process Steam



Two 4520 kW Back-pressure, and two 2500 kW Extraction Back-pressure turbine-generators are installed at the Merseyside Power Station of Lever Brothers, Port Sunlight, Ltd.

They are driven by the steam generated for process work and, operating in parallel with the National Grid, provide the electricity for the factory, helping to minimise overall fuel costs.

Extensive experience in the design and manufacture of extraction and back-pressure turbines enables AEI to advise on applications in your particular industry. For further particulars write to AEI Turbine-Generator Division, Rugby or your local AEI office.

AEI TURBINE-GENERATOR DIVISION

Associated Electrical Industries Limited

WORKS AT MANCHESTER AND RUGBY, ENGLAND · GLASGOW, SCOTLAND · LARNE, NORTHERN IRELAND

Manweb's Record Year

IN the 12 months ended 31 March, the Merseyside and North Wales Electricity Board supplied more than 5½ million units to its consumers—an increase of nearly 9% on the previous year's figure. During the latter part of the year the increase was running at the rate of some 15%—and even more in North Wales.

During the year more than 20,000 new consumers were connected to the board's supply, including 1,600 farms (200 more than in 1958).

Appliance sales in the board's showrooms rose by 50% to a record £3½ million. Some 28,000 cookers, 21,000 water heaters, 8,000 refrigerators and 13,000 washing machines were sold, all considerably up on the previous year (more than double in the case of refrigerators).

Cooker Colour Fashions

DURING 1959 a distinctive change took place in consumer colour preference for electric cookers, according to an analysis carried out by the Modern Cooking Promotional Committee. A definite swing away from cream towards white as the most popular shade took place.

In January last year about one-third of electric cookers sold were white, 61% were cream, and 6% were other colours. By September, the fashion had changed. The all-white cooker had taken over half of the market, cream had dropped to 40%, and other colours had dwindled to 4%.

The Committee suggest that the exceptionally sunny summer may have played its part in this odd change of colour choice.

Sayings OF THE WEEK

"There are no over-developed countries. We are a little further on than some people, but that is all. The scientific processes which have been shaking the world since the sixteenth century have not come to an end. They have scarcely begun." . . . LORD HAILSHAM, speaking at Sheffield.

"The control of inflation through retarding economic progress by means of monetary control, credit restriction or interest manipulation is as fallacious as trying to control atmospheric conditions by interference with the mechanism of the barometer or thermometer." . . . J. JAEGER, writing to the *Financial Times*.

"The overseas customer was now capable of deciding what he wanted, when he wanted it, and what he was prepared to pay for it." . . . MR A. H. FRAMPTON, joint managing director, Hawker Siddeley Industries Ltd., speaking at British Institute of Management conference.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, April 5

	£ per ton	Weekly change £
COPPER, standard class A (settlement)	254	−2
,, (3 months)	240⅝	+1½
LEAD, refined pig, 99·97% purity (cash)	78	+1½
,, (3 months)	76½	+½
TIN, refined, min. 99·75% purity (settlement)	790½	+1½
(3 months)	786½	+1½
ALUMINIUM, ingots 99·99·5% ...	186	—
wire bars (4 × 4 × 54")	209	—
BRASS Strip 63/37	218½	−½
SILVER (Troy oz)	79d	—

	£ per ton	Weekly change £
ZINC, virgin, min. 98% purity (cash)	91½	−2½
,, (3 months)	89½	−1½
RUBBER, per lb.		
No. 1, R.S.S. spot	34½d	−⅛d
c.i.f. basis, ports, June	34½d	—
ARMOURING:		
Galv. Steel Wire (0·104 in.) ...	66½	—
Mild Steel Tape (0·04 × 1½ in.)	53*	—
NICKEL (home)	600	—
MERCURY (76 lb flask)	70½	—
AMERICAN PRICES:		
Copper, electrolytic (per lb) ...	33c	—
Lead (New York)	12c	—

* *Tape Price, now an average, includes varnishing*

THE THREE SCIENTIFIC FREEDOMS: *THOUGHT, INDUSTRY, TRADE*

THE free sharing of scientific information and thought was a generally accepted principle, Mr F. J. Erroll, Minister of State, Board of Trade, suggested at the Plastics Institute dinner in London last week. But scientific thought had to be applied in terms of industry, and here freedom diminished.

The development of ideas and processes had a direct monetary value recognised by the existence of legislation in most countries to confer rights of property. In the absence of freedom of applied science, we needed freedom of trade.

Britain had consistently pursued a policy of freer international trade, Mr Erroll went on. At present, two different mechanisms to that end existed in Europe—the Common Market and the EFTA. At the same time, all of the countries concerned, together with Canada, USA and other members of OEEC, have joined talks in Paris. Why have all these different mechanisms when all cherish one aim in common, namely, freer trade?

"The Government is convinced that freer trade is in the interest of all peoples, and will continue to seek means of achieving the common ground which does exist between all these countries."

I.E.E. AWARDS

SIR WILLIS JACKSON remarked on his rare pleasure at being able to welcome two Nobel prizewinners to the IEE last week, when Professor C. F. Powell delivered the fifty-first Kelvin lecture on Cosmic Radiation. Sir George Thompson was present to receive the Faraday Medal, awarded for his outstanding contributions to the electrical sciences and research, and also for his inspiring services to education and technology.

Before presenting the Faraday Medal to Sir George Thomson, the president welcomed two new honorary members, Colonel B. H. Leeson and Dr R. L. Hearn. Prizes were also awarded by Sir Willis Jackson to several Higher National and Diploma students. In presenting the Page prize to G. T. Gillies the president commented that this award made at the beginning of a career could be compared with the presentations he had previously made to men distinguished in the profession.

Loans for Expansion

MANAGING directors of 47,000 manufacturing firms throughout the UK last week received a letter from the Board of Trade pointing out that Government aid (in the form of loans to assist in building premises) is available to firms willing to expand in areas where unemployment is persistently high.

These areas, known as "Development Districts," are subject to constant review, and they are listed in a leaflet entitled *Expanding Industry*, sent to virtually all firms employing 25 or more people.

News in Brief

Representatives of 51 local authorities in Lancashire and Cheshire have agreed to set up a consultative committee to consider the lighting of main trunk roads throughout the area and to make recommendations for greater uniformity and continuity of lighting.

Battersea Borough Council have decided to undertake street lighting maintenance by direct labour.

A new 115 cell, 66 Ah Chloride battery and control gear has been installed at the Royal Albert Hall to provide emergency lighting.

A record sum of £330, including a cheque for £100 from an anonymous donor, was subscribed to the EIBA by some 300 members and guests at the recent annual dinner-dance of the West Yorkshire branch.

The third annual dinner of the Institute of Physics will be held at Park La Hotel on 3 May.

An agreement has been signed in New Delhi between the Indian Government and Marconi's Wireless Telegraph Co. Ltd. for co-operation in the local manufacture under licence of equipment of Marconi design.

WORKS AT MANCHESTER AND RUGBY, ENGLAND · GLASGOW, SCOTLAND · LARNE, NORTHERN IRELAND

Company Activities

NOW that the Budget is out of the way, we can expect the return of more positive attitudes on the part of stock market operators and investors in general. For something like a fortnight before the Chancellor's revelations and remedies on Monday industrial markets had been marking time with little selling and little buying. Now the continuing flow of cheerful company news, coupled with the removal of Budget uncertainty, will enable the fundamentally firm ground of share values to be built upon.

Beyond the electrical field, but nonetheless indicative of the recovery from the 1958 industrial recession and which is, therefore, not without significance for electrical investors, we have recently had the excellent results from Imperial Chemical Industries which are inclined to set the tone for the whole market. Group sales for the year ended 31 Dec., 1959, were up from £463 million to £509 million, while group income before tax rose remarkably by no less than 64% from £44·51 to £73·11 million. Equity earnings accelerated from £13·7% to 24·6% which permitted the dividend increase from 8% to 11¼%.

From chemicals to oil. Shell, too, pleased the market with a spurt in net income from £18·8 million to £23·3 million, equity earnings up from 65·7% to 72·7% tax free on the year (over 80% in the last quarter of the year) and the dividend 5% more at 23¾% tax free.

Meanwhile, electrical companies continue to make news. The full accounts of Associated Electrical Industries, whose sales rose 14½% last year to £208 million, show that they compare with sales of £56·86 million in 1950 while trading profits in the same period have risen from £7·41 million to £11·09 million. Profit to sales ratios—13% in 1950, 5·3% in 1959—are a striking comment on the withering of profit margins in the electrical industry. Investors, however, have far from neglected the £1 Ordinary shares of this £218 million giant where Lord Chandos sits as chairman. In 1950 there were 10,522 holders of the company's then £6 million Ordinary stock, an average of £568 each. In 1959, there were 84,433 holders of £41,303,595 Ordinary stock, an average of £489. But perhaps the most significant figures are those which show that individual members, excluding insurance companies, banks, trusts, etc., have grown in number from 10,044 in 1950 to 79,699 in 1959 with their average holding increasing from £224 million to £279. Last week saw little activity in AEI's shares, now around 54s 9d (11s 9d below their 1960 peak) to yield an extremely attractive 5·5%, but more interest may develop on the chairman's statement on 21 April.

There was also news last week from the "twins" C. A. Parsons and Co. and from A. Reyrolle and Co. Parsons' profits rose by close on £267,000 to £3,648,689, and the dividend was effectively raised from 8¼% to 9¼%. Quite a respectable result, although the £1 Ordinary shares, after touching 52s after the announcement, came back to 49s 6d. A. Reyrolle on the other hand, which owns 40% of the Parsons equity, kept the year's payment of 17½% unchanged, although net profit was higher at £1,428,021 against £1,358,257 previously. Down came the £1 "A" shares a 1s to 92s and compares with the year's "high" of 104s 6d. Now on a dividend yield basis of nearly 4% we can expect a forward movement here as the momentum of heavy industry swings into higher gear.—*From our City Correspondent.*

Hoover Ltd.

Turnover in the home market in the first 11 weeks of the current financial year is slightly up on last year, while exports are 35% up, Mr S. Roberts, managing director, told shareholders at last week's meeting. But he warned that the appliance industry had often been the target for Government interference either by imposition of credit restrictions or purchase tax. Certain official measures have already been taken this year to damp down demand, but, if further steps are taken and the whole chain of creeping restrictions is repeated, then the industry will be completely disrupted as it was in 1955-56. It is the home market volume which creates the opportunities to develop exports, and any artificial restriction of this volume will have an adverse effect on our competitive position overseas, he added. Incidentally, we should make it clear that the company were responsible for nearly 80% of all cleaners and washing machines exported from Britain last year—not 80% of its total output as we stated on 24 March.

A. H. Hunt (Capacitors) Ltd.

A new factory is to be built at Hampden Park, Eastbourne, in addition to the new buildings at Wrexham (now occupied) and extensions at New Addington, a programme with the modernisation of machinery, which is estimated to cost about £500,000 spread over three years. A considerable amount of this expenditure will fall in the first year, however, and the directors are, therefore, raising about £250,000 by a rights issue of new Ordinary shares. Subject to unforeseen circumstances, the directors expect to maintain the present 20% dividend on the increased capital.

Parkinson Cowan

In addition to its large gas interests, this concern has strong electrical activities in Measurement Ltd. and Parkinson Cowan Instruments Ltd., apart from the more recent venture into the domestic appliance side with a spin dryer. Mr Hugh P. Barker, chairman, reports that in the past year's excellent trading, the meter and instrument divisions had a poor year, though towards the end business improved and is now running at a very satisfactory level. The 1959 boom for domestic appliances was unprecedented, but in view of tightening conditions he considers it unlikely that 1960 will repeat the performance of 1959, although the company expect to do well. But he issues a warning on appliance production which we report on page 584.

C. A. Parsons and Co. Ltd.

A small increase in consolidated profit for 1959 is reported. The total is £3,648,689, compared with £3,381,738 for the previous year. Total distribution is raised by 1¼% to 9¼% with a final dividend of 5%. Net profit, after tax, is £2,209,114 (*£2,091,114*).

Radio and Television Trust

In their offer to acquire all the issued shares of British Communications Corporation, this concern suggest 40 RTT Ordinary 6d shares for every seven 7½% Redeemable Cumulative Preference in BCC. In addition 1,200 Ordinary 6d RTT shares are offered for every £1 Ordinary in BCC.

A. Reyrolle and Co. Ltd.

After taxation charged at £1,157,984 (*£1,353,724*), the net profit for 1959 is £1,428,021, compared with £1,358,257 for the previous period. Dividend is maintained at 17½% with a final of 11% again.

Sangamo Weston Ltd.

Dividend is being raised from the equivalent of 9¼% to 11% for the year to 31 Dec. last, on the capital increased by a one-for-three scrip issue. Trading profit for the year is £422,451, compared with £382,235 for 1958. After taxation, etc., net profit is £164,608 (*£135,526*).

Superheater Co.

For 1959 the trading balance is £732,593 (*£823,378*), and a final dividend of 17½% again makes the total distribution 25%. Net profit, after tax, is £403,561 (*£408,742*).

Telephone and General Trust

The group net profit for 1959, after tax, is £501,345 (*£422,458*). Dividend is raised 1% to 15% with a final of 10%.

J. and G. Weir Holdings

After smaller taxation charge, group net profit for 1959 is £1,256,143 (*£1,123,173*). Dividend is raised 1% to 18% with a final of 12%.

Dividends Declared

Dimplex. Interim 10%.

Perak River Hydro Electric Power Co. Interim 4% (*nil*).

Joseph Lucas (Industries). Interim 2½% (*same*).

Sperryn and Co. Interim 5% (*4%*).

J. and F. Stone Lighting and Radio. Interim 12½% (*10%*).

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

7 April—Beddington and Wallington B.C. 54 Group "A" and 70 Group "B" concrete columns, 60 and 140 W sodium lanterns.—See 17 March issue.

7 April—Downpatrick R.D.C. Electrical installations (contract 28): Tyrella, eight houses; Raholp, 12 houses; Sheepland Moor, 16 houses. (Contract 29): Strangford, four houses; Ardglass, five houses.—See 31 March issue.

7 April—Dublin T.C. Fire and intruder alarm systems at Municipal Art Gallery, Parnell Sq.—See 31 March issue.

8 April—Glasgow T.C. Supply of (item 2) electrical fittings to lighting dept. for year from 1 June.—See 24 March issue.

8 April—Glasgow T.C. (9) Electrical and (13) lightning conductor work at Castlemilk Fire Station. Applications to City Architect and Planning Officer, 20 Trongate, Glasgow C.1, by above date.

8 April—Moray C.C. Electrical work in proposed 30 houses, Sanquhar Forres. Applications to County Architect, Elgin, by above date.

9 April—Atherton U.D.C. Supply, erection and wiring of 222 reinforced concrete columns and brackets for Group "A" lighting.—See 24 March issue.

9 April—Cornwall C.C. (g) Electrical services on fixed-price basis in Penryn County Secondary School.—See 31 March issue.

9 April—Lanark First District Council. Electrical work in erection of community centre at Rigside.—See 31 March issue.

9 April—Margate B.C. Electrical installation, by contractors on N.I.C.E.I.C. roll, in library at Westgate.—See 31 March issue.

11 April—Bath C.C. Electrical installations, by contractors on N.I.C.E.I.C. roll, in 94 dwellings and communal laundry, Snow Hill Redevelopment. Applications to architects, Snailum and Le Ferre, 18 Brock St, Bath, by above date. Deposit £1 1s payable to Bath Corpn.

11 April—Bentley with Arksey U.D.C. Electrical installations in 23 bungalows, Redbourne Rd.—See 31 March issue.

11 April—Birmingham C.C. Electrical services installation in cottages 5 and 6 and sick bay at Shenley Fields Cottage Homes, Northfield. Deposit £2 2s payable at office of Sir Herbert J. Manzoni, City Engineer, Civic Centre, Birmingham 1.

11 April—Co. Londonderry. Electrical installation in new voluntary primary school at Draperstown.—See 17 March issue.

11 April—Dunfermline T.C. Separate trades tender—electrical in 36 flats/cottages, Kingseat and Townhill; and in 50 flats/cottages, Headwell Ave. Applications to Burgh Architect, 6 Abbott St, by above date.

11 April—Gateshead. (2) Electrical installation in new Divisional Fire Station to be erected in Dryden Rd.—See 25 Feb. issue.

11 April—Inverkeithing T.C. Electrical work in proposed civic centre. Applications to Town Clerk, R. Mitchell, Burgh Chmbrs, Inverkeithing, by above date.

11 April—Lancs C.C. Electrical installations in Chorley Hostel for Aged Persons and Stretford Boys' Grammar School. Applications to County Architect, P.O. Box 26, County Hall, Preston, by above date, reference A/.

11 April—Wallasey T.C. (b) Electrical installations.—See 31 March issue.

12 April—Armagh C.C. Sub-contract (a) electrical installation in proposed Tangragee Intermediate School.—See 24 March issue.

12 April—Cannock U.D.C. Supply and installation of two horizontal centrifugal pumping sets with total capacity of 1,500 g.p.m. of crude sewage at a 45 ft head for Bridgtown Pumping Station.—See 17 March issue.

12 April—Hebburn U.D.C. (2) Electrical installations in 17 dwellings on Edward St Housing Site.—See 31 March issue.

13 April—Durham C.C. (a) Electrical installation in Peterlee Grammar Technical School. Applications to County Architect, Shire Hall, Durham, by above date.

13 April—Esher U.D.C. Provision and erection of street lighting columns, brackets, fittings, etc., 15 25 ft steel columns, 140 W sodium; 178 19 ft concrete columns, 60 W sodium; 14 15 ft steel columns, 2 x 40 W fluorescent; and replacement of 15 tungsten by 60 W sodium lanterns.—See 24 March issue.

13 April—Manchester C.C. Electrical maintenance work at Dr Garrett Memorial Home, Conway. City Architect, P.O. Box 488, Town Hall, Manchester 2.

14 April—Birmingham C.C. Contract 630, electrical installations in shops, flats and maisonnettes, Garretts Green estate. Deposit £2 2s payable to City Engineer and Surveyor, Sir Herbert J. Manzoni, Civic Centre, Birmingham 1.

14 April—Birmingham C.C. Supply of 2,500 c.i. Class "B" columns; combined lanterns and brackets; 4,000 synchronous time switches; 500 "Keep Left" bollards for year from 1 May. City Engineer and Surveyor, Civic Centre, Birmingham 1.

14 April—West Riding C.C. Rewiring of Boston Spa Primary School and Stainforth Junction Rd Primary School. Applications to County Architect, Bishopgate, Westfield Rd, Wakefield, by above date.

15 April—Cork. Supply of electrical canteen equipment at St. Finbarr's Hospital, for South Cork Board of Public Assistance. One each—tilting frypan, 20 gal stockpot, 10 gal stockpot steamer, hot cupboard, dishwasher and drier, food mixer and two fans.—See 24 March issue.

16 April—Wexford B.C. (1) Lighting installations in 22 houses, Fisher's Row. Housing Engineer, T. J. Millar.

19 April—Wallasey T.C. Electrical installation in Egerton Grove School extensions and alterations.—Advertised 31 March issue.

20 April—Brighouse B.C. (a) Supply of 44 400 W mercury discharge units and gear and (b) provision/erection of 44 25 ft prestressed reinforced concrete columns, brackets plus installation of tender (a) equipment.—See 31 March issue.

22 April—Bromsgrove U.D.C. Supply and putting into service of 35 prestressed concrete columns, 25 ft mounting height, with totally enclosed 140 W sodium lanterns—alternatively 28—200 W sodium lanterns on 30 ft steel columns, along Stoke and Tunstall roads. Engineer and Surveyor. Deposit £3 3s.

22 April—Galway C.C. Supply and installation of duplicate 3-ph. motors, horizontal centrifugal pumps and chlorination unit for Ballymoe Water Supply Scheme.—See 3 March issue.

23 April—Cardiff. Supply of h.v. laboratory equipment, including 300 kV testing transformer and 330 kV impulse generator for Welsh College of Advanced Technology. Details from The Principal, Cathays Pk, Cardiff.

25 April—East Riding C.C. Supply and erection of 13 cut-off sodium lanterns, etc., of 25 ft steel fluted columns at A64 Spital roundabout. County Surveyor, County Hall, Beverley. Deposit £2.

25 April—Newmarket R.D.C. Supply and erection of vertical spindle sewage pumps in two stations for Burwell, contract includes motors, control gear, valves, piping and other ancillary gear. Details from consulting engineers, H. Brompton and Partners, 7 Hobart Pl, S.W.1. Deposit £3 3s payable to R.D.C.

26 April—Belfast. (c) Electrical installation in new voluntary primary school at Clady Corner for Very Rev T. Hegarty. Details from architects, F. M. Carr and W. H. D. McCormick, 7 Ferryquay St, Derry. Deposit £26 5s.

27 April—Ealing B.C. Contract A—supply of 106 3 x 80 W fluorescent lanterns/lamps and 46 400 W MBF/U lanterns, lamps and control gear. Contract B—supply and erection of 150 25 ft steel columns. Borough Engineer, Town Hall, W.5. Deposit £5 each contract.—Advertised in this issue.

27 April—Sutton Coldfield B.C. Supply and erection of sodium vapour lamps/lanterns and 30 ft steel columns on A453, Tamworth Rd. Borough Surveyor's Office. Deposit £2.

28 April—Isle of Axholme R.D.C. Supply and erection duplicate centrifugal un-

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 108 queries answered this week

"Hostess" electrically heated food trolleys—makers of? T.E.—L. G. Hawkins and Co. Ltd., 30/35 Drury La, W.C.2.

"Horstmann" adjustable desk lamp—address for? L.E.—Simms Motor Units Ltd., Oak La, N.2.

"Klixon" motor burnout protection device—makers of? S.E.B.—Salford Electrical Instruments Ltd., Magnet Hse, Kingsway, W.C.2.

"Beeantee" strip lighting lampholders—address for? C.P.—Beeantee Illuminations (London) Ltd., 69 Upper St, N.1.

"Excel" cookers — address for? S.W.E.B.—Selex Electric Co. (Kirkby) Ltd., Yardley Rd, Kirkby Industrial Estate, Kirkby, nr. Liverpool.

"Ceiling Master" easy removal ceiling lighting fitting system—makers of? W.W.—Lewden Metal Products Ltd., 5 Argall Ave, Lea Bridge Factory Estate, E.10.

Sunvic Controls Ltd.—address for? L.E.B.—A.E.I. Instrumentation Division, Crown Hse, Aldwych, W.C.2.

"Wallis" refrigerators — spares for? L.E.B. — Acre Refrigeration Co., 389 Green Lanes, N.4.

Burglar alarm mats—makers of? H.E.—Rely-a-Bell Burglar and Fire Alarm Co. Ltd., 54 Wilson St, E.C.2.

chokeable sewage pumps each of 120 g.p.m. and one 50 g.p.m. sludge pump. Details from consulting engineers, John H. Haiste and Partners, 20 Wood La, Headingley, Leeds 6. Deposit £3 3s payable to R.D.C.

29 April—Kilwinnning T.C. Supply of 73 140 W lanterns for A78 lighting. Burgh Surveyor.

30 April—Glantawe Hospital. Applications for inclusion in prescribed lists of contractors for (B) electrical supplies; (E.7) electrical work, (E.9) maintenance of refrigerators, to Group Secretary, T. E. Jones, Management Committee, St. Helen's Rd, Swansea, by above date.

2 May—Willenhall U.D.C. Provision and fixing of Group "B" 80 W mercury discharge lighting and erection only of Stanton 9A concrete columns. Engineer and Surveyor.

3 May—Enniskillen. Electrical installation, by registered contractors, in new voluntary school for boys, Derrin Rd.—See 31 March issue.

4 May—Wandsworth T.C. Supply and erection of 2,600 steel and concrete columns plus ancillary gear for sodium discharge lighting. Borough Engineer.—Advertised in this issue.

5 May—Manchester T.C. (2) Provision of a five-ton o/h crane for Davyhulme Sewage Works Extensions.—See 31 March issue.

6 May—Glasgow T.C. Electrical installations in Bridgeton and Shettleston libraries. City Architect and Planning Officer, 20 Trongate, Glasgow C.1. Work to be completed between June and September.

No date stated—Ashby-de-la-Zouch R.D.C. Supply and installation of fluorescent lighting fittings and ancillary works at Council Offices, South St.—See 24 March issue.

No date stated—Berkshire C.C. Supply and erection of 11 35 ft steel columns, lanterns and other works for Maidenhead By-Pass/A4 roundabout at Maidenhead Thicket.—Advertised 17 March issue.

No date stated—Sidmouth U.D.C. Supply of cast-iron street lighting columns, 12½ ft high.—See 24 March issue.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

16 April—Iran. 20,000 70 Ah 1·45 V dry batteries. Iran Telephone Co., Tehran. B.o.T. (ESB/8800/60).*

18 April—India. Distribution transformers from 15 kVA to 1,000 kVA and up to 33 kV/400 V in quantities from 1 to 102. Bombay State Electricity Board. B.o.T. (ESB/8706/60).*

18 April—India. 200 l.t. metering sets. Andhra Pradesh State Electricity Board, Hyderabad. B.o.T. (ESB/8576/60).*

18 April—India. 110 kV double-circuit angle transmission towers for Poringalkuthu-Sholayar line. Chief Engineer, Kerala State Electricity Board, Trivandrum 1. B.o.T. (ESB/9240/60).*

19 April—Sudan. 150,000 yd 7/·056 P.B.J. aluminium conductor. Central Electricity and Water Dept., Khartoum. B.o.T. (ESB/8777/60).*

20 April—India. 36,000 s.-ph. h.s. meters. Superintending Engineer, Technical (Electrical), Andhra Pradesh State Electricity Board, Hyderabad. B.o.T. (ESB/8577/60).*

21 April—India. 1,400 11 kV switches. Andhra Pradesh State Electricity Board, Hyderabad. B.o.T. (ESB/8578/60).*

21 April—Pakistan. 41 items of transmitting and substation equipment. Director-General Supply and Development, Frere Rd, Karachi. B.o.T. (ESB/8753/60).*

26 April—Guatemala. 4,000 street lighting lamps with standard supports 220 V, 100 W. Departmento de Bienes Nacionales y Licitaciones, 3A Calle No. 3-49, Zona 1. B.o.T. (ESB/8759/60).*

28 April—India. Four s.-ph. 7,067 kVA transformers for Jaldhaka H.E. project. Specification JLK/402, fee Rs. 25, from Chief Engineer, M. Datta, West Bengal State Electricity Board, 1 Hastings St, Calcutta 1.

2 May—India. Five 250/300 kW, 400 V, 3-ph. low speed diesel generators. Specification, fee Rs. 10, Chief Electrical Engineer, M. R. Sitaram, Assam State Electricity Board, Shillong.

16 May—India. Power circuit-breakers, instrument transformers, disconnecting switches and lightning arresters for Sharavathi power station and Shimoga and Bangalore receiving stations, Mysore. B.o.T. (ESB/7256/60).

28 June—New Zealand. Four s.-ph. 16,667 kVA 220/19·05 kV (alternatively 127/33 kV) outdoor, oil immersed, natural cooled transformers and one 3-ph. 33 kV earthing transformer. N.Z. Electricity Dept., Wellington. B.o.T. (ESB/8525/60).*

CONTRACTS PLACED

Hartlepool T.C. Electrical installations 22 houses, Headland area, and 40 in Throston area, J. Westmorland and Co., £2,454.

London C.C. Supply and installation of water heaters, Downham estate, F. J. Baynes and Co. Ltd., £16,340 16s; electrical installations renewal, Princes Meadow estate, Aquinas St, H. Dunn and Son, £3,058 15s; supply and maintenance two lifts in Block 1 Spring Walk site, Stepney, Express Lift Co. Ltd., £9,978; three replacement pumping sets for Lots Rd, Pulsometer Eng. Co., £24,003.

Northumberland C.C. Electrical work in schools: stage lighting, Whitley Bay Grammar School, J. W. Potts, £314; boilerhouse, Bellingham School Camp, D. Allan, £332; Wooler Infants' School, I. and E. Morton, £587.

Tynemouth B.C. Supply of sodium lanterns for year, Abacus Eng. Ltd.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Bonnibabe. 791,609. Class 11. Thermostatically controlled babies' feeding bottle heating apparatus. Bonnibabe Products Ltd., 14/16 Philpot La, E.C.3.

Chark-el. 795,101. Class 9. Apparatus, etc. 795,102. Class 11. Baking installations, etc. Katherine Mary Farnsworth, 109 Balgores La, Romford, Essex.

Dynamatic 796,000 and **E.E.C.** in design. 796,352. Class 7. Washing, drying machines, etc. Elizabethan Eng. Co. Ltd., Stansted Rd, Bishop's Stortford, Herts.

Ericsson in design. 773,601. Class 9. Apparatus, etc. Ericsson Telephones Ltd., 22 Lincoln's Inn Fields, W.C.2.

GEI in design. 793,182. Class 9. Apparatus. Gothic Electronic Industries Ltd., Beacon Wks, Hampton St, Birmingham 19.

Marvo. 788,232. Class 11. Space heaters and hair drying appliances. J. D. Kenwood and Co., Egerton Wks, Elliott St, Oldham, Lancs.

Plukan. 796,748. Class 9. Connections, plugs, sockets, etc. Plessey Co. Ltd., 1 Broad St Pl, E.C.2.

Pye. 770,486. Class 9. Illuminated advertising signs. Pye Ltd., Radio Wks, St. Andrew's Rd, Cambridge.

Semicron. 793,466. Class 9. Selenium current rectifiers. J. Langham Thompson Ltd., 176 High St, Bushey Heath, Herts.

Spacevector. 787,314. Class 11. Heating apparatus for drying and airing clothes. Benjamin Parkes and Sons Ltd., Woodsetton Wks, Brook St, Woodsetton, near Dudley, Worcs.

Tefbond. 797,971. Class 9. Covered wire, cables, conduits. Wandleside Cable Wks Ltd., 106 Garratt La, S.W.18.

Gazette Announcements

COMPANIES ACTS

Electricians Ltd. General meetings of members and creditors to be held at offices of Parkin S. Booth and Co., 5 Rumford Pl, Liverpool 3, on 3 May, at 2.30 and 2.45 p.m., respectively.

Evelyn Electrics Ltd. Meeting of creditors to be held at Bonnington Hotel, Southampton Row, W.C.1, on 12 April, at 3 p.m.

Moxham's Electrical Engineers Ltd. Creditors to send details to liquidator: A. T. Eaves, 47 Mosley St, Manchester 2, by 28 April.

Morbury Electricals Ltd. Last day for receiving proofs for intended dividend: 12 April, to liquidator: W. H. Meredith, County Court Bldgs, Westgate St, Cardiff.

Hampden Co. (Merchants) Ltd. Petition for winding-up to be heard before High Court of Justice, Strand, on 11 April. Persons intending to appear to notify Buckridge and Braune, 3/4 Clements Inn, W.C.2, by 1 p.m. 9 April.

Domestic Appliances (Doncaster) Ltd. Mr P. Cardwell, 93 Queen St, Sheffield 1, appointed liquidator at extraordinary general meeting of members on 29 March.

Valley Electrics Ltd. Meetings of members and contributories to be held at Official Receiver's Office, Pearl Chmbrs, East Parade, Leeds 1, on 8 April at 11 and 11.30 a.m., respectively.

BANKRUPTCY ACTS

Receiving Order

High Court of Justice. F. R. Shortland, electrical contractors, trading as F. R. Shortland and Sons at 52 Brook Drive, S.E.11. Receiving order dated 25 March.

Appointment of Trustee

Wrexham. H. E. Williams, electrical dealer, formerly carrying on business as Johnstown Electrical Co., at Merlin St, Johnstown. Mr N. C. Sunter, Midland Bank Chmbrs, High St, Wrexham, appointed trustee as from 22 March.

Intended Dividend

Barrow-in-Furness. C. Sykes, electrician, 10 High Kepplewray, Broughton-in-Furness. Last day for receiving proofs for intended dividend: 13 April, to trustee: D. Atkinson, 14 Lowther St, Carlisle.

Release of Trustee

High Court of Justice. E. V. Williams, electrician, 5 Cleveland Passage, N.16. Trustee: G. F. Morris, Bankruptcy Bldgs, Carey St, W.C.2, released as from 23 March.

First Meeting and Public Examination

Haverfordwest. D. H. Rees, electrical contractor, of 5 Vergam Terr, Fishguard. First meeting: 11 a.m., 8 April, at Official Receiver's Office, Britannic Bldgs, 103 Lammas St, Carmarthen; and public examination: 10.45 a.m., 12 May, at Shire Hall, Haverfordwest.

TRADE NOTES

Changes of Address. Hagan Controls Ltd. have moved to 14 Grosvenor Pl, S.W.1. Telephone: Belgravia 6382.

The Glasgow office of Turner Brothers Asbestos Co. has moved to 80 York St.

The London office of Whipp and Bourne Ltd. is now at 128 Blackfriars Rd, S.E.1. Telephone: Waterloo 6016.

Harris and Russell Ltd. have this week moved to 51 Calthorpe St, W.C.1. Telephone: Terminus 9122.

New Telephone No. The London office telephone no. of the Incandescent Heat Co. is now Belgravia 7803.

Agency. Tellux Ltd. have decided to relinquish the distribution rights for Telefunken valves and radios, in order to concentrate on marketing Sony transistor radios made in Japan and Southern Ireland.

BUSINESS PROSPECTS

Alton. 65,000 sq ft Mill La bakery proposed by John Trent, E.10.

Ballymena R.D.C. Tender: 55 houses at Broughshane site. Clerk of Council.

Basildon. Hosking and Son, Rayleigh, are contractors for Transformer and Electric Co. extensions.

Bathgate. Harry W. Weedon and Ptnrs, 45 Calthorpe Rd, Edgbaston, Birmingham 15, architects for British Motor Corpn. £9 million factory.

Bishop Auckland. Cordingley and McIntyre, Owengate, Durham City, are architects for Woodhouse Close Estate Methodist Church.

Blackburn. Bradshaw, Gass and Hope, 19 Silverwell St, Bolton, architects for £550,000 Royal Infirmary extensions.

Brentford. J. Mendleson and Ptnrs, 71 Wimpole St, W.1, are architects for Brentford Soap Wks, Catherine Wheel Rd, factory extensions.

Brierley Hill U.D.C. Tender: Assembly hall being Civic Centre extension. Architect.

Brighton. Planning applications: Market St shopping precinct for Metropolitan Estate, 16 Hanover Sq, W.1.—Alterations at 155 North St by National Provincial Bank, London.

Cambridge. Brandt and O'Dell, 12 Queen Anne St, W.1, electrical engineers for £350,000 medical school at Hills Rd. Co-Partnership, 44 Charlotte St, London W.1, architects for King's College hostel off Market Sq. T.C. Tender: kitchen and plant at new Donkey's Common swimming pool. Surveyor.

Chesterfield. P. Hassal Ltd., Dronfield, propose 80 dwellings in Somersall La.

Chesham U.D.C. Tender: Street lighting in improvements Trapps La Caravan Site. Engineer and Surveyor.

Derby. Corpn. plans £120,000 abattoir.

Dublin. Hooper and Mayne, 19 Upper Merrion St, architects for £1 million College of Technology.

Eastbourne. College of Further Education development plans provisionally approved.

Eccles B.C. Tender: Peel Green Branch Library. Town Clerk.

Edenbridge. F. G. Minter, 4 Buckingham Gate, S.W.1, are contractors for McGarry and Cole, £70,000 Station Rd factory.

Edinburgh. £30,000 biophysics dept. extension plans for University approved by Dean of Guild Court. Crudens Ltd., Musselburgh, contractors for Ferranti Silverknowes factory. Robt. Mathew and Johnson-Marshall, 31 Regent Terr, architects for University arts faculty, George Sq.

Evesham B.C. Tender: 38 dwellings at Bewdley La. Town Clerk.

Feltham. Feltham Industrial Properties, and Elliot Addressal, Victoria Rd, propose 22,000 sq ft N. Feltham factory.

Galashiels T.C. Tender: 35 houses, Elm Row/Church St. Town Clerk.

Gateshead. Smith's Delivery Vehicles, Team Valley estate, propose works extensions; Grieves and Elliott, Stoddart St, Newcastle, propose East Gateshead factory.

Glasgow. Remington Rand propose 130,000 sq ft plant extensions at Hillington.—Leslie and Co., Peel St, Kensington, London, W.8, are contractors for rebuilding Arnott Simpson's Jamaica St department stores, and for new Drumchapel township shops centre.—Keppie, Henderson and Ptnrs, 21 Woodside Pl, C.3, are architects for University biochemistry block.—£500,000 maternity unit proposed by Women's Hospitals Board for Royal Samaritan Hospital for Women.

Guernsey. T. M. Burrows and Ptnrs, 44 Bedford Row, W.C.1, are architects for £100,000 Port Peter shops/offices.

Hants C.C. Recommended to approve H. W. Edgehill, Hook, factory extensions.

Harlow. Langdon and Every, 21 Russell Sq, W.C.1, are quantity surveyors for factory/office block, Templefields, for R. F. Thompson (Engineers) Ltd.

Hartlepool. Streetly Co. plan £3 million Pallister Wks extensions.

Hereford. W. S. Atkins and Ptnrs, 158 Victoria St, S.W.1, consulting engineers for H. Wiggin and Co., Holmer Rd, factory development.

Heston. Two-block Southall La training centre planned by BEA.

Hove. H. Fairweather and Co., St. James' La, N.10, propose purchase Western Rd sites for shops/flats.

Lanarks. John Wight and Co. Earls Gate Wks, Grangemouth, Stirlingshire, contractors for Ministry of Works East Kilbride laboratory.

Lancs C.C. Ministry approved 500-students' accommodation, Salford Royal Technical College.

Leeds. Hospital Board approved £35,000 adaptations, Westwood Hospital maternity block; proposed 24-bed ward, Bempton La Hospital; Lloyd Hospital improvements; and £727,000 Storthes Hall Hospital modernisation; to submit to Ministry £300,000 developments, St. James's Hospital. Wm. Sugden and Co., Marshall Mills, Leeds 11, propose depot/offices, Sweet St.

Leighton Buzzard. Thompson and Alexander, 6 Cromwell Pl, S.W.7, quantity surveyors for £50,000 Camden Motors factory, Groverbury Rd.

London. Paul Castle, 34 Belsize Pk, N.W.3, architect for Providence Pl factory.—Planning permission sought by L.C.C. for Islington abattoir £250,000 rehabilitation scheme. Ian Fraser and Ass, 16 Bedford St, W.C.2, architects, for C. and A. Modes, Kentish Town premises. Gordon and Gordon are architects for J. Perkins and Son Colombo St, S.E., factory extension.—C. A. and F. C. Reavell, 5 Bedford Row, W.C.1, quantity surveyors for James Clark and Eaton, Gt. Suffolk St, S.E., factory.—Kenneth Lindy, J. Hill and Ptnrs, 24 St. Mary's Axe, E.C.3, architects for Albert Embkmt offices. R. Ward and Ptnrs, 29 Chesham Pl, S.W.1, architects for 529-531 Fulham Rd shops/offices.—Richard Sheppard, Robson and Ptnrs, 5 Southampton Pl, W.C.1, architects for Imperial College Princes Gdns Hall of Residence.—Watson and Costing, 57 London Rd, Reigate, architects for two-site Moscow Rd, W.1, shop/office development.—H. Fitzroy, Robinson and Ptnrs, 3 Gray's Inn Sq, W.C.1, architects for £450,000 Norwich Union Ins. Soc. Tottenham Ct Rd offices.—J. Jarvis and Sons, 239 Vauxhall Bdg Rd, S.W.1, contractors for £22,000 office block, Golden Sq.—S. B. Harbour, 43 Grosvenor Sq, architect for North Row offices/flats.—Easton and Robertson, Cusdin, Preston and Smith, 53 Bedford Sq, are architects for Gt. Ormond St Hospital's three-storey addition.—W. Willett, Sloane Sq, S.W.1, contractors for £130,000 Hounsditch offices. Hammond and Miles Ltd., contractors for Usher-Walker Ltd. factory, Marshgate La, E.15. Ord, Carmell and Kritzler, 27 Stamford Hill, architects for Fairbridge Rd factory, N.19. E. H. Burgess Ltd., contractors for R. B. Pullen Ltd. extensions at Great West Rd.

Lytham St. Anne's. Clifton Aircraft Ltd. plan new assembly shop at West Cliffe.

Manchester. Plans approved for: Shendan Shirts Ltd. factory extensions; one-storey Charter St factory, Byrom Properties Ltd.

Milford Haven U.D.C. Milford Haven Industrial Developments, 346 Kilburn High Rd, N.W.6, land development application approved.

Milnrow. J. Berry, Chapel St, Heywood, contractors for £100,000 J. Holroyd and Co. factory extensions.

Newbury. Planning application by Lloyds Bank, London, for The Broadway offices.

Newcastle. Metal Box Co. Ltd., 37 Baker St, W.1, propose plastics factory adjoining premises at Newburn Industrial estate.

Northfleet. A. F. Taylor, 70 East Hill, Dartford, contractors for £450,000 electrical engineering factory, Granby Rd.

Northumberland C.C. W. B. Edwards and Ptnrs, 5 Claremont Bldgs, Newcastle, architects for Willington Quay, Wallsend, Junior School.—D. Brown, 10 Lambton Rd, Newcastle, is architect for Ashington Secondary School and Holy Cross Junior School.

N. Shields. Wood and Pigg, 17a Northumberland Sq, architects for G. Davidson and Sons factory, Walker Pl.

Perivale. Percy Bilton Ltd., Uxbridge Rd, to build Simmonds Bedding Ltd. factory extensions.

Peterborough. Planned extensions to Baker, Perkins Ltd. experimental dept. at Westwood.

Poole. Langdon and Every, 21 Russell Sq, W.C.1, are quantity surveyors for General Hospital rebuilding.

Ruislip. Farmer and Dark, Romney Hse, Tufton St, S.W.1, are architects for Detel Products, Victoria Park estate offices.

Sedgley. Planning application for Upper Gornal factory by M. E. Scott, 157 Wolverhampton Rd.

Sheffield. Hoare, Lea and Ptnrs, 23 St. James Rd, Edgbaston, Birmingham 15, are electrical consultants for St. George's Sq University metallurgy dept.—Hadfield, Cawkell and Davidson, 17 Broomgrove Rd, are architects for University student hostel near Endcliffe Grange. T. H. Mawson Ltd., architects for £300,000 lab. and factory at Thorncliffe for Newton, Chambers and Co. Ltd.

South Shields. Alston Limestone Co., Lynwood Terr, Westgate Rd, Newcastle, are contractors for Tyne Chemical Co. River Drive factory extensions.

Southampton. B. C. Sutcliffe, Brandt and Ptnrs, 57 Above Bar, recommended architects for conversion of Regent's Pk Girls' School as science lab.

St. Andrews. University Court plan £2 million extension.

Stockton-on-Tees. J. Walton Taylor and Son, St. James Bldgs, Gallowgate, are architects for Henry Moat and Sons warehouse, Wharf St.—F. B. Dixon, Norton Rd, is architect for 55 houses at South Rd, Norton.

Sunderland. Matkin and Hawkins, Barclays Bank Chmbrs, Fawcett St, are architects for A. Cameron and Sons Hendon Rd offices/laboratory.

Surrey. Factory extensions planned by Marsden and Shiers, Davis Rd; and Chrystal Products, Hook Rise, Surbiton; B.B.C. plan laboratories at Kingswood Warren.

Taunton B.C. Tender: 30 flats, Lane estate. Borough Architect.

Thornbury. British Extracting Co. seek approval for 80,000 sq ft Avonmouth mill.

Thorne. C. F. Taylor and Co., North Easter Rd factory extensions approved.

Truro T.C. Tender, 20 dwellings, Malabar estate. City Engineer.

Tynemouth. John Laing and Son, Dalston Rd, Carlisle, contractors for Formica works extensions, Coast Rd.

Welwyn Gdn City. C. Miskin and Co., contractors for £300,000 Aviation Developments factory at Black Fan Rd.

Westerham. Ind. Coope and Allsopp, London, propose development of Westerham Brewery.

West Lothian. E.C. Three-year programme approved including: £85,000 primary school at Bathgate West; £336,000 senior school, Broxburn; £75,000 and £32,000 primary schools, Linlithgow; £10,000 improvements to Longridge Primary School; £150,000 technical college, Bathgate; £130,000 primary school, Uphall; £30,000 primary school, Winchburgh; £500,000 senior school, Bathgate; £450,000 secondary school, Whitburn; £350,000 senior school, Armadale, £100,000 extensions, etc., to Linlithgow Academy, £80,000 school, Bridgend; £80,000 South Queensferry secondary dept.; £55,000 school, Winchburgh.

Wigan. Edmund Taylor (Engineers), Skull House La factory extensions approved. Industrial Reels' Lamberhead Green factory extension plans approved.

Wokingham. Wokingham Plastics Ltd. plan factory at Eastheath Industrial estate.

MEETINGS TO NOTE

THURSDAY, 7 APRIL

I.E.E. (Utilisation Section). Three papers: Speed Control 3ph. I. Motors; Screwdown Control; Linear Machines. Joint meeting with London Graduate and Student Section. Savoy Pl. 5.30 p.m.

I.E.E. (N. Scotland Sub-Centre). "Engineering Education in the Technical Universities in Western Germany," D. B. Welbourn, Prof D. B. Spalding and G. L. Ashdown. Electrical Eng. Dept., Queens College, Dundee. 7 p.m.

I.E.E. (S.W. Sub-Centre). "A New Cathode Ray Tube for Monochrome and Colour Television," D. Gabor, P. R. Stuart and P. G. Kalman. Plymouth "B" Generating Station, Prince Rock. 3 p.m.

I.E.E. (Southern Centre). "Sound Reproduction," D. E. L. Shorter. S. Dorset Technical College, Weymouth. 6.30 p.m.

PLASTICS INSTITUTE (Southern Section). "Synthetic Jewels," R. C. Chirnside. Chemistry Dept., The University, Southampton. 7.30 p.m.

INSTITUTE OF PHYSICS (Liverpool-N. Wales Branch). "New Techniques in Electron and X-ray Microscopy," C. W. Oatley. Liverpool University. 7 p.m.

BRITISH INSTITUTION RADIO ENGINEERS. "The Work of the B.S.I. in Relation to the Radio and Electronics Industry," H. A. R. Binney. London School of Hygiene and Tropical Medicine, Keppel St, W.C.1. 6.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Data Processing Section). "The Electronic Computer as a Unit in an Automatic Data Processing System for Missile Trials," W. C. J. White and D. L. Overheu. Manson Hse, 26 Portland Pl, W.1. 7 p.m.

I.E.S. (Manchester Centre). A.G.M. Demonstration Theatre, Town Hall Extension. 6 p.m.

I.E.S. (Nottingham Centre). "Trends in Lamp Design, 1884 to 1984," E. E. Miles, Electricity Centre, Carrington St. 6 p.m.

A.S.E.E. (S.W. London Branch). "Electrical Equipment in Coal Mines," P. W. Wyke. Prince of Wales Hotel, S.W.19. 7.45 p.m.

FRIDAY, 8 APRIL

I.E.E. (Electronics and Communications Section). Symposium on Data Handling and Display Systems for Air Traffic Control. Savoy Pl. 2.30 p.m.

I.E.E. (N. Scotland Sub-Centre). "Engineering Education in the Technical Universities in Western Germany," D. B. Welbourn, Prof D. B. Spalding and G. L. Ashdown. Robt. Gordon's Technical College, Aberdeen. 7.30 p.m.

I.E.E. (Southern Centre). "Rockets and Satellites," Dr G. V. Groves. S.E.B. Showrooms, Newport, I.o.W. 6.30 p.m.

I.E.E. (Southern Centre). Dinner/dance. Bedford Hotel, Brighton. 7.30 p.m.

I.E.E. (N.E. Graduate and Student Section). "H.V. Impulse Testing of Transformers," J. R. Bennett. Grey Hall, King's College, Newcastle. 6.30 p.m.

JUNIOR INSTITUTION OF ENGINEERS. "The Atomic Clock," Louis Essen. Pepys Hse, 14 Rochester Row, S.W.1. 7 p.m.

INSTITUTE OF PHYSICS (Non-destructive Testing Group). "Nuclear Fuel Element Inspection," R. S. Sharpe. 47 Belgrave Sq, S.W.1. 6 p.m.

A.S.E.E. (Luton Branch). "H.F. Sound Reproduction." Luton College of Technology, Park Sq. 8.15 p.m.

MONDAY, 11 APRIL

I.E.E. Discussion, "Public Lighting." Savoy Pl. 5.30 p.m.

I.E.E. (N.E. Centre). A.G.M. and conversazione. Royal Station Hotel, Newcastle upon Tyne. 6.15 p.m.

I.E.E. (N. Staffs Sub-Centre). "Silicone Transistors—their Manufacture and Fields of Application," J. T. Kendall. English Electric Co., Kidsgrove. 7 p.m.

I.E.E. (Western Centre). "Development of H.V. Air-break Circuit-breakers with Insulated-steel-plate Arc Chutes," F. S. Fay, J. A. Thomas, D. Legg and J. S. Morton. Electricity Hse, Bristol. 6 p.m.

BIRMINGHAM ELECTRIC CLUB. "Electricity on Board Ship," M. J. Bolton. Grand Hotel. 6.15 p.m.

I.E.S. (Sheffield Centre). A.G.M. and "Industrial Lighting," R. H. Sanders. Grand Hotel. 6.30 p.m.

A.S.E.E. (C. London Branch). "Variable Speed Drives." V. W. Press. White Hall Hotel Bloomsbury Sq., W.C.1. 7.15 p.m.

TUESDAY, 12 APRIL

I.E.E. (Medical Electronics Discussion Group). "Aids for the Blind." Savoy Pl. 6 p.m.

I.E.E. (N.W. Supply Group). Turbo-generator Performance Under Exceptional Operating Conditions," T. H. Mason, P. D. Aylett and F. H. Birch. Engineers' Club, Albert Sq, Manchester. 6.15 p.m.

I.E.E. (N. Ireland Centre). "Subscriber Trunk Dialling." D. A. Barron. David Keir Bldg, Queen's University, Stranmillis Rd, Belfast. 6.30 p.m.

I.E.E. (S.W. Scotland Sub-Centre). "High-current-density-Thermionic Emitters: A Survey," A. H. W. Beck. Royal College of Science and Technology, Glasgow. 6 p.m.

I.E.E. (Southern Graduate and Student Section). A.G.M. C.E.G.B. Offices, Portsmouth. 6.30 p.m.

INSTITUTE OF PHYSICS (London/Home Counties Branch). "Physics of Insulation," C. G. Garton. Electrical Research Association, Leatherhead.

I.E.S. "Office Lighting," L. H. Hubble. Federation of British Industries, 21 Tothill St, S.W.1. 6.15 p.m. Joint meeting with A.S.E.E.

A.S.E.E. (Chester Branch). "Maintenance Lifts," J. H. Cooke. Westminster Hotel, City Rd, Chester. 7.45 p.m.

A.S.E.E. (S.E. London Branch). "Heating Elements," R. J. Locock and F. W. Price. Eltham Green School, Queenscroft Rd, S.E.9. 7.45 p.m.

A.S.E.E. (York Branch). "Protection of Metals Against Corrosion," Dr Cowan. Georgian Hse, Blossom St. 7.30 p.m.

WEDNESDAY, 13 APRIL

I.E.E. (Supply Section). "Water-turbine-driven Induction Generators," C. L. C. Allan. Savoy Pl. 5.30 p.m.

I.E.E. (N. Lancs Sub-Centre). "Development of H.V. Air-break Circuit-breakers with Insulated-steel-plate Arc Chutes," F. S. Fay, J. A. Thomas, D. Legg and J. S. Morton. N.W.E.B. Lecture Theatre, Jubilee St, Blackburn. 7.15 p.m.

I.E.E. (S.E. Scotland Sub-Centre). "High-current-density Thermionic Emitters: A Survey," A. H. W. Beck. Carlton Hotel, North Bridge, Edinburgh. 7 p.m.

I.E.E. (Southern Centre). "Provision of Adequate Electrical Installations in Buildings," "Houses," C. C. Hyams, "Multi-storey Flats and Maisonnettes," C. A. Belcher. Kings Arms Hotel, Christchurch. 6.30 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (Computer Group). "Guided Weapon Control," F. R. J. Spearman. London School of Hygiene and Tropical Medicine, Keppel St, W.C.1. 6.30 p.m.

NEWPORT AND DISTRICT ELECTRIC CLUB. "Electricity in the Coal Industry," R. Hamilton. King's Head Hotel, Newport. 6.30 p.m.

WOMEN'S ENGINEERING SOCIETY. "Plastics in Engineering," Dr L. P. Smith, Hope Hse, 45 Gt. Peter St, S.W.1. 7 p.m.

A.S.E.E. (Birmingham Branch). "Electronics in Industry," R. J. F. Howard. Exchange and Engineering Centre, Stephenson Pl, Birmingham 2. 7.30 p.m.

A.S.E.E. (Manchester Branch). "Some Modern Aspects of Industrial Lighting," D. R. Pritchard. Engineers' Club, Albert Sq. 7.15 p.m.

THURSDAY, 14 APRIL

I.E.E. (W. Wales Sub-Centre). "Electronic Applications in a Modern Steelworks," J. K. Edwards. Conference Room, S.W.E.B. Showrooms, The Kingsway, Swansea. 6 p.m.

A.S.E.E. (Bradford Branch). "Design and Safety of Electrical Installations and Apparatus," F. Clarke. Midland Hotel. 7.30 p.m.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

Angus and Taylor Ltd., 254 Oldham Rd, Failsworth. To carry on business of designers, manufacturers of and dealers in radio, television and electrical sets, etc. Nom. cap.: £1,000. Dirs.: Alan A. Taylor and Peter T. Angus.

C. W. Burst Electrical Ltd. Nom. cap.: £500. Dealers, distributors, repairers of electrical equipment, etc. Dirs.: Cecil W. Burst and Peggy M. A. Burst, 72 Whittlesea Rd, Harrow Weald.

Central Audio Ltd., 10 Old St, E.C.1. To carry on business of general electronic and electrical furnishers, etc. Nom. cap.: £500. Dirs.: David R. A. Ellis and G. Fox.

Copeland and Jenkins Ltd. To acquire from Copeland and Jenkins Ltd. the goodwill, undertaking and assets appertaining to its business of processing mica and other materials for the electrical, electronic and allied industries, etc. Nom. cap.: £100. Dirs.: not named. Subs. C. G. Stickler and S. E. Reeder, 11 Old Jewry, E.C.2.

Contract Sales (Eastern) Ltd., 141 Stamford Hill, N.16. Dealers in and manufacturers of vacuum cleaners, washing machines, etc. Nom. cap.: £1,000. Dirs.: to be appointed by subs. Subs.: Hyman Adelman and Stanley L. Kiddle.

Egacon Fittings Ltd., 57 Blandford St, W.1. Importers, exporters, manufacturers of and dealers in electrical, radio, gas, water, radar, television and scientific instruments, etc. Nom. cap.: £1,000. Dirs.: Gerald J. Claremont, Fredk. A. W. Payne, Norman Boyrd and Ernest H. Clarke.

Electrical Enterprises Ltd., 9 St. John's Rd, Cattedown, Plymouth. Manufacturers of and dealers in domestic appliances, etc. Nom. cap.: £100. Dirs.: Clarence C. T. Clarke, Leslie W. Abbott and Sidney Parker.

Enolacto Ltd., 14 Clifford St, W.1. To carry on business of chemical engineers, manufacturers of and dealers in chemical, electrical, laboratory and scientific apparatus, etc. Nom. cap.: £100. Dirs.: Geoffrey Allen and Anna Ellen.

G. A. Gruby Ltd., 12 Mosley St, Newcastle-on-Tyne 1. To carry on business of electrical equipment specialists, etc. Nom. cap.: £100. Dirs.: Geo. A. Gruby and Margaret Gruby.

Holmes Electrical Ltd., The Offices of H. A. Maw, 8 Staniforth Rd, Sheffield 9. Manufacturers of and dealers in electrical goods, etc. Nom. cap.: £1,000. Permanent dirs.: Harold Holmes and Mrs Iris Holmes.

Home Market Supplies Ltd. To buy, sell and deal in furniture, electrical appliances, etc. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: Dorothy M. Graeme and Gordon V. Graeme, 61 Fairview Ave, Gillingham, Kent.

R. A. Jackson Ltd., 347 Linthorpe Rd, Middlesbrough. Manufacturers of and dealers in artificial lighting apparatus, electrical plant, etc. Nom. cap.: £1,000. Dirs.: Robert A. Jackson and Mrs V. Jackson.

Arthur W. J. Lewis and Co. Ltd., 36 Southampton St, W.C.2. To carry on business of consultants, experts, advisers and research workers in connection with inventions, manufacturers of and dealers in electrical and electronic equipment, etc. Nom. cap.: £100. Dirs.: Arthur W. J. Lewis, M.P., and Mrs Lucy E. Lewis.

Londex Navigation Ltd., 207 Anerley Rd, S.E.20. Manufacturers of and dealers in radar, wireless, electronic, electrical, photographic and mechanical equipment, etc. Nom. cap.: £1,500. Dirs.: Joseph Schweizer, Arthur Ney and Walter Stern.

Markwells (Electrical Supplies) Ltd., 32 Laburnum Rd, Maidenhead, Berks. Nom. cap.: £100. Dirs.: Alfred J. Markwell and Rita M. R. Wells.

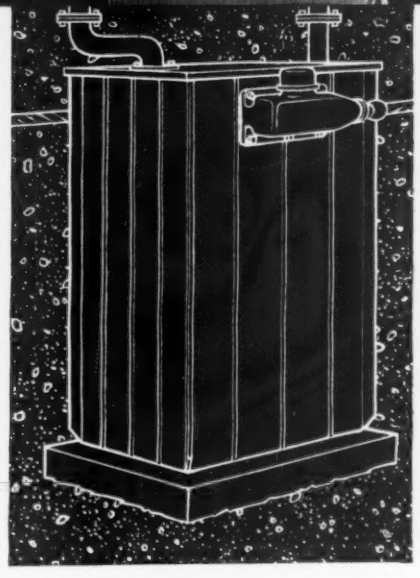
Modcharex Ltd., Moorgate Hall, Moorgate, E.C.2. Retailers, wholesalers, manufacturers of and dealers in electrical and mechanical apparatus, etc. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: Derek G. Williams and Geoffrey V. J. Sharpe.

H. G. Millett and Co. Ltd., Office Chmbrs, Lansdowne Hse, Christchurch Rd, Bournemouth. To take over the business of electrical engineers and distributors carried on at 60a Gladstone Rd, Boscombe, as "H. G. Millett and Co." etc. Nom. cap.: £1,000. Permt. dirs.: Herbert G. Millett and Mrs Irene M. M. Millett.

Newmarket Electrical Distributors Ltd., 57 Blandford St, W.1. Nom. cap.: £100. Dirs.: Gerald J. Claremont, Emanual Gee, Eric Benjamin and Clive Z. Berger. Sub.: Eric Benjamin.

Reliable Electrics Ltd. Nom. cap.: £100. Dirs.: to be appointed by the subs. Subs.: H. M. Greene, 50 Welbeck Grove, Salford 7.

B. Shrago Ltd., 27 Queen Anne St, W.1. Manufacturers of and dealers in electrical goods, etc. Nom. cap.: £100. Dirs.: Bertie Shrago and Sarah Shrago.



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HACKBRIDGE direct buried type TRANSFORMERS

AN ANSWER TO THE PROBLEM OF INSTALLATION IN CONGESTED AREAS

- Standard naturally cooled oil immersed transformer.
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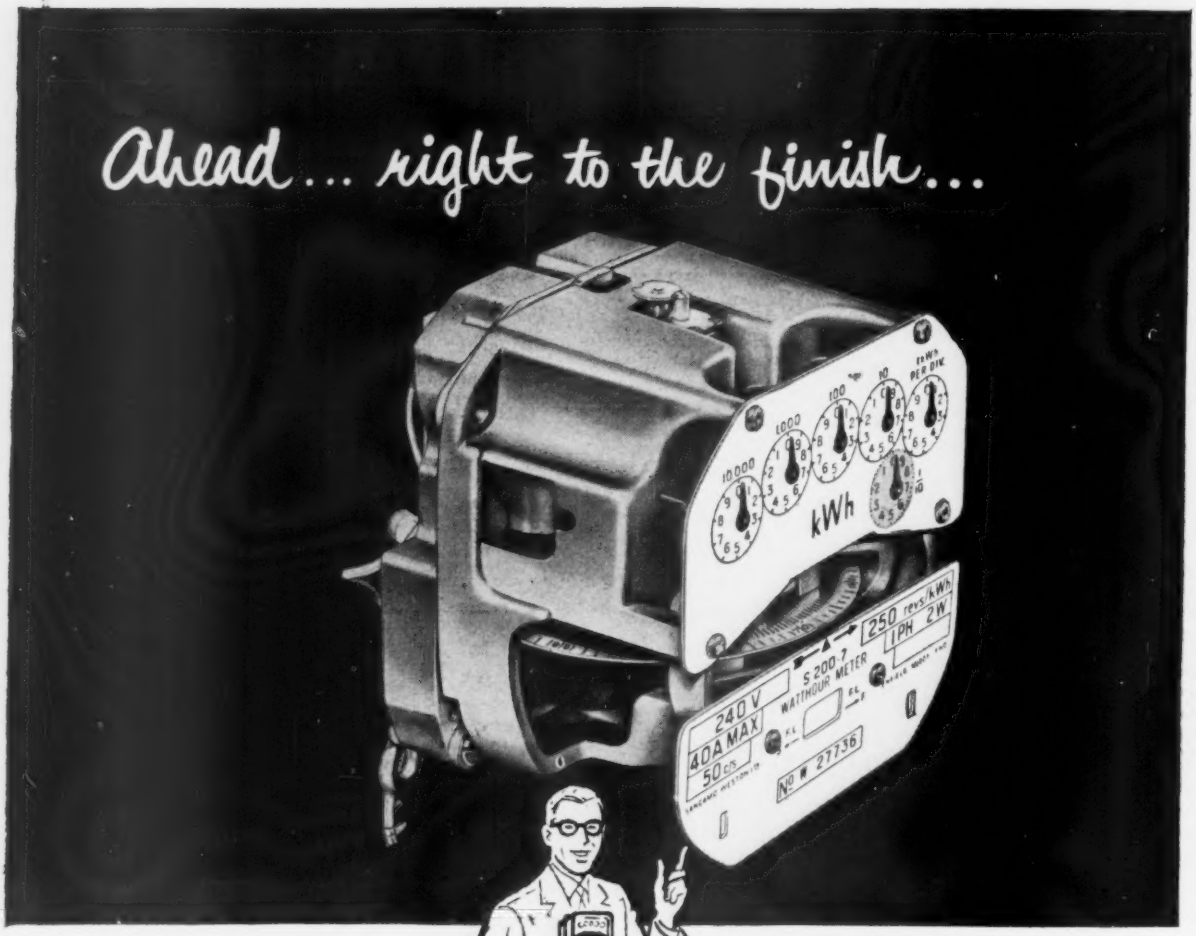

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SW/76

CLASSIFIED ADVERTISEMENTS

TENDERS INVITED

METROPOLITAN BOROUGH OF WANDSWORTH
STREET LIGHTING

TENDERS invited for supply and erection of steel and concrete lamp columns and ancillary gear for sodium discharge street lighting scheme involving 2,600 columns.

Tender documents, obtainable from the Borough Engineer, must reach me by 10 a.m., 4 May, 1960.

J. NOEL MARTIN,
Town Clerk.
Municipal Buildings,
Wandsworth, S.W.18. (P 579)

BOROUGH OF EALING
Street Lighting—Uxbridge Road and Boston Road, Class A
CONTRACT "A"

SUPPLY of 106—3 x 80 watt fluorescent lanterns complete with lamps, and 46—400 watt MBF/U lanterns complete with control gear and lamps.

CONTRACT "B"

Supply and erection of 150—25 ft mounting height steel columns.

Details obtainable from Borough Engineer, Town Hall, Ealing, W.5, on payment of £5 for each tender.

Returnable on receipt of a bona fide tender.

Tenders to Town Clerk, Town Hall, Ealing, W.5, by noon, 27 April, 1960.

E. J. COPE-BROWN,
Town Clerk.
(P 608)

APPOINTMENTS VACANT

SOUTH OF SCOTLAND ELECTRICITY BOARD
Stirling Area

SECOND ASSISTANT DISTRICT COMMERCIAL ENGINEERS (Vacancy ref. No. 26/60) required for the Bathgate, Falkirk and Stirling Districts of this Area. Salary: for Falkirk, N.J.B., G.7, £965 x £20—£1,025 per annum; and for Bathgate and Stirling, N.J.B., F.7, £910 x £15—£955 per annum.

DISTRICT COMMERCIAL ASSISTANT (Vacancy ref. No. 25/60) required for the Falkirk District of this Area. Salary: N.J.C. Grade 3, £720 x £20—£780.

Superannuated posts. Applications on the standard form, obtainable from the undersigned, to be returned not later than 18 April, 1960.

JAMES G. CURTIS,
Manager.
"Woodlands,"
St. Ninians Rd.
Stirling. (P 560)

CENTRAL ELECTRICITY GENERATING BOARD
South Western Division
ASSISTANT STATION CHEMIST

REQUIRED at East Yelland Power Station, North Devon.

Superannuation Scheme. Salary: N.J.B. Class II, Grade 11, £815/£860 per annum.

Applicants should have had practical Power Station experience, particularly in the analysis of coal, water and oil, etc., and should possess, as a minimum qualification the H.N.C. in chemistry or equivalent.

Applications on Form AE6/ACT, obtainable from the Divisional Secretary, 26 Oakfield Rd, Bristol 8, should be completed and returned by 19 April, 1960. Please quote vacancy SW/AV/40/60. (P 599)

SOUTHERN ELECTRICITY BOARD
GENERAL ASSISTANT ENGINEER

BOURNEMOUTH District of No. 4 (Bournemouth) Sub-Area. Salary: N.J.B. Class J, Grade 11 (£860 x £15—£905 per annum). N.J.B. conditions of service.

The successful candidate will be required to give general assistance in the preparation of schemes and estimates for extensions of and reinforcement to overhead and underground H.V. and L.V. networks. Applicants should have had sound experience in Electricity Supply Distribution and the possession of suitable technical qualifications would be an advantage. The successful candidate will be required to carry out standby duties if and when called upon to do so and to contribute to the Electricity Supply Staff Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, 1 Priory Rd, Bournemouth, and returned to him, quoting Z1162, not later than 18 April, 1960. (P 601)

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments. The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Essex Sub-Area
THURROCK DISTRICT
THIRD ASSISTANT ENGINEER
61/60.N.

Candidates should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. overhead and underground systems, including substations.

Salary: N.J.B. Class F, Grade 9 (£815/£860), plus £50 London Allowance.

Apply by letter to H. J. Unwin, Esq., A.M.I.E.E., Manager, Thurrock District, Eastern Electricity Board, Maidstone Rd, Grays, Essex, by 22 April, 1960.

Suffolk Sub-Area
NORTH EAST SUFFOLK DISTRICT
(a) DISTRICT COMMERCIAL ASSISTANT
73/60.R.
(b) DISTRICT COMMERCIAL ASSISTANT (HALESWORTH)
74/60.R.

Candidates for (a) should have had a sound training and experience in commercial development work in rural areas. Experience of industrial and farming installation work is essential and also a practical knowledge of electro-agricultural utilisation and equipment.

Candidates for (b) should have had a sound training and experience in commercial development work in urban and rural areas and be competent estimators for electrical installations and have a good practical knowledge of electrical installation, space heating and water heating.

Salary for each appointment: N.J.C. Grade 3 (£720/£780).

For these appointments apply by letter to J. H. Shepherd, Esq., A.M.I.E.E., Manager, North East Suffolk District, Eastern Electricity Board, The Grove, Ingate, Beccles, Suffolk, by 18 April, 1960. (P 607)

CITY AND COUNTY OF NORWICH
ASSISTANT ELECTRICAL ENGINEER

APPLICATIONS are invited for the above appointment at a salary in accordance with APT Grade III (£880/£1,065) or the Special Grade (£785/£1,070), according to experience and qualifications. Applicants must have the Higher National Certificate or be Graduates of the Institution of Electrical Engineers, have served an apprenticeship in electrical installation work and have had experience in the design and suppervision of street lighting and interior lighting and power installations.

Canvassing, directly or indirectly, will be a disqualification. Applicants should state age, qualifications, training, experience, present and previous positions, giving salaries and dates, together with names of three referees.

Applications should be delivered to the City Engineer, City Hall, Norwich, NOR 01A, not later than Monday, 18 April, 1960. (P 603)

THE NORTH EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments which are subject to the N.J.B. Agreement for the Electricity Supply Industry.

1. Area Board Headquarters

(a) CHIEF DRAUGHTSMAN, CHIEF ENGINEER'S DEPARTMENT, Operation and Maintenance Section, with location at Carliol Hse, Newcastle upon Tyne.

Applicants must have had extensive experience of drawing office work, preferably in association with the Electricity Supply Industry, and be conversant with up-to-date drawing office practice and organisation.

Salary: Schedule D, Grade 1, £1,340/£1,490.

(b) FOURTH ASSISTANT ENGINEERS, CHIEF ENGINEER'S DEPARTMENT, Technical Section, for general technical duties.

Applicants must possess H.N. Certificate in Electrical Engineering, or its equivalent, and experience with H.V. Protection Equipment, Instruments, Electronics or Meters, will be an advantage.

Salary: Schedule B, Grade 8: £735/£935.

2. Tyne Sub-Area

(a) ONE FIRST ASSISTANT DISTRICT COMMERCIAL ENGINEER with location at Ashington District.

Applicants should have experience in utilisation of electrical energy in commercial and domestic premises, knowledge of installation work and be conversant with tariffs, sales and all aspects of consumer service.

Possession of Higher National Certificate or Higher National Diploma in Electrical Engineering or higher qualifications will be an advantage.

Salary: : Schedule A, Class E, Grade 5, £965/£1,025.

3. Tees Sub-Area

(a) ONE SENIOR DRAUGHTSMAN, with location at Sub-Area Headquarters, Princess St., Thornaby-on-Tees.

Applicants must be able to carry out site surveys, prepare working drawings for brick substations and similar buildings and minor civil engineering works and be competent to undertake simple design calculations. Preference will be given to candidates who possess the Higher National Certificate in Mechanical Engineering (structural group) or building construction.

Salary: Schedule D, Grade 5, £790/£890.

Applications stating age, qualifications and experience, to be received by Assistant Secretary (Establishments), The Northern Secretary (Establishments), The North Eastern Electricity Board, G.P.O. Box No. 117, Carliol Hse, Newcastle upon Tyne, within 10 days of the appearance of this advertisement. (P 596)

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 40s. per inch, and all other classified advertisements at 3s. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

CENTRAL ELECTRICITY GENERATING BOARD
Midlands Division

STATION SHIFT CONTROL ENGINEER is required at Hams Hall "A" Power Station, near Birmingham. N.J.B. service conditions, superannuable appointment, salary within Schedule A of the Agreement, Grade K10, £965/£1,025 per annum, plus 10% of basic salary for shift duties.

A sound technical training and practical experience in the control of steam generating plant and main switchgear are required. Appropriate technical qualifications an advantage.

Apply, quoting Vacancy No. 62/60MD, on form AE6, available from the Establishments Officer, 53 Wake Green Rd, Moseley, Birmingham 13, by 20 April, 1960. (P 569)

SOUTH OF SCOTLAND ELECTRICITY BOARD
Lanarkshire Area

APPLICATIONS are invited to fill the undernoted vacancies:

SECOND ASSISTANT DISTRICT ENGINEER
HAMILTON DISTRICT

Applicants should have experience in the maintenance and operation of H.V. and L.V. overhead and underground networks, including the maintenance of H.V. substations on a large distribution system.

Salary Scale: Class F, Grade 7, £910/£955 per annum.

THIRD ASSISTANT DISTRICT ENGINEER
LANARK DISTRICT

Applicants should have experience in the operation and maintenance of H.V. and L.V. distribution systems and be conversant with Load Flow Diagrams and Voltage Drop Calculations.

Salary Scale: Class E, Grade 9, £765/£810 per annum.

FOURTH ASSISTANT ENGINEER (TEST)
AREA TRANSFORMER AND PROTECTION TEST DEPARTMENT—MOTHERWELL

Applicants should have experience in the testing and commissioning of modern protective equipment and be conversant with voltage drop and short circuit calculations and H.V. fault location.

Salary Scale: Class L, Grade 13, £860/£905 per annum.

FOURTH ASSISTANT ENGINEER
AREA OPERATION AND MAINTENANCE DEPARTMENT

Applicants should have experience with operational and maintenance work on H.V. and L.V. distribution systems.

Salary Scale: Class L, Grade 13, £860/£905 per annum.

SECOND ASSISTANT DISTRICT COMMERCIAL ENGINEERS (FIVE VACANCIES)
COATBRIDGE, HAMILTON, LANARK, MOTHERWELL AND RUTHERGLEN DISTRICTS

Applicants should have experience in the development of industrial loads and of off-peak supplies to all classes of consumers and will be required to assist in the general work of the commercial department.

Salary Scales: Coatbridge District: Class H, Grade 7, £1,025/£1,085 per annum; Hamilton District: Class F, Grade 7, £910/£955 per annum; Lanark District: Class E, Grade 7, £860/£905 per annum; Motherwell and Rutherglen Districts: Class G, Grade 7, £965/£1,025 per annum.

Applicants for each appointment should have had a sound engineering and technical training.

The appointments are superannuable and the conditions of employment will be in accordance with the National Joint Board Agreement, Schedule A.

The successful candidates will require to reside within a reasonable distance of the appropriate offices.

Application forms, which may be obtained from the undersigned, should be forwarded to this office within 14 days of the date of this advertisement.

R. J. RENNIE,
Manager.

Montrose Cres,
Hamilton. (P 558)

SOUTH WEST METROPOLITAN REGIONAL HOSPITAL BOARD
REGIONAL ENGINEER'S DEPARTMENT

APPLICATIONS are invited for the following appointments on the permanent staff of the Board generally in accordance with the Whitley Council conditions of service.

(i) SENIOR ASSISTANT ENGINEER (ELECTRICAL)

(ii) ASSISTANT ENGINEER (ELECTRICAL)

Applicants for (i) should be Corporate Members of the Institution of Electrical Engineers and for (ii) should have passed the Institution's examination, and be Graduate Members of the Institution, and be experienced in the preparation of specifications, drawings and estimates for electrical installations in hospitals and large public buildings.

Salary: (i) at the minimum of the scale (under review) £1,050 x £30(3) x £35(3)—£1,245 p.a., plus a London Weighting allowance of £50 p.a.; (ii) £730 x £25(2) x £30(2) x £35(5) x £40(1)—£1,055 p.a., plus London Weighting allowance of £20/£50 p.a. The commencing salary, (ii) only, may be fixed above the minimum of the scale for relevant practical experience.

Applications for (i) stating age, qualifications, experience, present appointment and salary, together with the names and addresses of three referees, should be sent to the undersigned at 40 Eastbourne Terr, London W.2, by not later than 16 April.

Candidates for (ii) should obtain application forms from the undersigned at the same address.

E. G. BRAITHWAITE,
Secretary.
(P 576)

THE CORPORATION OF GLASGOW
Architectural and Planning Department
ASSISTANT ENGINEER (ELECTRICAL)

APPLICATIONS for the above, superannuable, appointment are invited from Graduates and Associate Members of the Institution of Electrical Engineers. Salary scale: £795/£1,240 with placing according to qualifications and experience. There is a point within the scale at which increments may be accelerated.

Applications with full particulars to the City Architect and Planning Officer, 20 Trongate, Glasgow C.1.

A. G. JURY,
City Architect and Planning Officer.
(P 517)

CENTRAL ELECTRICITY GENERATING BOARD
Eastern Division

APPLICATIONS are invited for the following appointments at Divisional Headquarters (Cockfosters) in NORTH LONDON.

FOURTH ASSISTANT ENGINEERS
DIVISIONAL ELECTRICAL DEPARTMENT
(DESIGN AND CONSTRUCTION BRANCH)

Salary: N.J.B., Class AX/DX, within the range of Grades 7/8, £775 x £25—£1,090 p.a., inclusive of London Weighting.

The commencing salaries will be within the above range at a point commensurate with qualifications and experience.

Applicants should have qualifications equivalent to Graduate Membership of one of the Institutions of Electrical, Civil or Mechanical Engineering.

The applicants appointed will be required to assist in the construction of high voltage substations, overhead lines, and will provide a suitable basis for promotion to a higher technical grade.

Applications, quoting reference S.V. No. 1225, stating age, qualifications, experience and present position, should be sent to the Controller, Central Electricity Generating Board, Eastern Division, West Farm Pl, Chalk La, Cockfosters, Barnet, Herts, to arrive not later than 16 April, 1960.

(P 568)

THE SOUTH WALES ELECTRICITY BOARD
FIRST ASSISTANT COMMERCIAL ENGINEER (CONTRACTING)

APPLICATIONS are invited for the position of First Assistant Commercial Engineer (Contracting) at the Head Office of the Board, St. Mellons, Cardiff.

The salary for the position will be within Class AX/DX, Grade 2 (£1,475/£1,705). The successful applicant will be appointed at a commencing salary of £1,600 per annum.

Applicants should preferably be Chartered Electrical Engineers and have a wide experience in modern methods of electrical contracting.

The person appointed will be responsible to the Board's Assistant Commercial Engineer (Sales, Contracting and Publicity) for the organisation and development of the Board's Installation Contracting work and repair of appliances. He should have wide experience in the following:

Preparation of Specifications and Bills of Quantities.

Estimating for wiring and power installations.

Recent experience in a large contracting organisation dealing with all aspects of contracting and appliance repair work.

Lecturing on and courses in both the engineering and commercial aspects of contracting.

Candidates should also be accustomed to working with senior staff.

Applications stating age, present position, present salary, qualifications and experience should be addressed to the undersigned at St. Mellons, Cardiff, so as to arrive not later than Saturday, 16 April, 1960.

Previous applicants need not reapply.

Envelopes should be marked "First Assistant Commercial Engineer (Contracting)—S.V. 17/60."

PRINCIPAL ASSISTANT (ESTABLISHMENTS)

Applications are invited for the position of Principal Assistant (Establishments) in the Secretary's Office of the Board at St. Mellons.

Applicants should have extensive experience of general administration, preferably in personnel and establishment work, and should possess an appropriate professional qualification. A knowledge of the Electricity Supply Industry's negotiating machinery would be an advantage.

The salary for the position will be in accordance with Grade 7 (£1,070/£1,160) of the National Joint Council (Administrative and Clerical Grades) Agreement for the Electricity Supply Industry.

Applications stating age, present position, present salary, qualifications and experience should be addressed to the undersigned at St. Mellons, Cardiff, so as to arrive not later than Saturday, 16 April, 1960. Envelopes should be endorsed "Principal Assistant (Establishments)—39/60."

R. G. WILLIAMS,
Secretary.
(P 556)

CITY OF BIRMINGHAM PUBLIC WORKS DEPARTMENT
Mechanical & Public Lighting Section

VACANCY FOR ELECTRICAL ENGINEER
SPECIAL GRADE £785/£1,070 p.a.

APPLICANTS should be Associate Members of the Institution of Electrical Engineers or hold the Higher National Certificate.

Candidates should have experience of lighting engineering with particular reference to public lighting.

The post is permanent, superannuable and subject to a medical examination.

Applications stating qualifications, age and experience and naming two referees should reach the undersigned by 23 April, 1960.

Canvassing disqualifies.

HERBERT J. MANZONI,
City Engineer and Surveyor.

Civic Centre,
Birmingham 1. (P 557)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2

CENTRAL ELECTRICITY GENERATING BOARD
North Eastern and Yorkshire Region

THIRD ASSISTANT ENGINEER
(TELECOMMUNICATIONS)
TECHNICAL DEPARTMENT

APPLICATIONS are invited for the appointment as Third Assistant Engineer in the Telecommunications Section of the Technical Department, Yorkshire Division, based on Rotherham.

Applicants should have technical qualifications generally of the standard required for Corporate Membership of the I.E.E. and be experienced in applications of telecommunication technique for supervisory, telemetering and intertripping purposes as well as to automatic telephones. Works experience will be an advantage.

The salary for the appointment will be in accordance with the National Joint Board Agreement (£925/£1,170 per annum) and will commence at a point commensurate with qualifications and experience.

Forms of application may be obtained from the Assistant Regional Secretary (Personnel) Central Electricity Generating Board, North Eastern and Yorkshire Region, 1 Whitehall Rd, Leeds 1, to whom they should be returned to arrive not later than 20 April, 1960. (P 567)

GOVERNMENT OF SOMALILAND

ELECTRICAL FOREMAN

REQUIRED by Public Works Department on contract for two tours each of 18 months in first instance. Salary according to age and experience in scale (including inducement addition) £813 rising to £1,173 a year. Gratuity at rate of 12½% of total salary drawn during each completed period of three months' service. Outfit allowance £60. Free passages. Liberal leave on full salary. Candidates, preferably between 28-40 years of age, must have served full apprenticeship to electrical engineering and had five years' subsequent experience in maintenance and installation of electrical machinery, overhead line distribution (both low tension and up to 11,000 volts) and internal installation work. They must be conversant with I.E.E. and U.K. Electricity Regulations. Experience in operation and maintenance of diesel generating power stations and control of staff and funds an advantage. Write to the Crown Agents, 4 Millbank, London S.W.1, State age., name in block letters, qualifications and experience and quote M2A/50995/EE. (P 600)

AIR MINISTRY

REQUIRE ASSISTANT MECHANICAL and ELECTRICAL ENGINEERS for design, construction and maintenance of installations on airfields, radar stations, missile bases, workshops and maintenance units for R.A.F. at home and overseas as well as certain Civil Airports. Salary: £805 at 25 to £1,095 at 34 or over, thereafter rising to max. £1,260 with increase for London and slight decrease for country districts. Appointments non-pensionable but long term. Promotion prospects. Five-day week with four weeks two days leave a year initially. Special allowance in addition to salary during overseas service. Quals. and experience:

(i) (a) University degree or equiv. diploma in electrical and/or mechanical engineering with at least two years' apprenticeship; or

(b) Graduate or corporate member of I.E.E. with at least three years' apprenticeship; or

(c) Graduate or corporate member of I.Mech.E., appreciable electrical engineering experience with at least three years' apprenticeship; and

(ii) Have been employed for minimum of two years with well established engineering concern and gained wide experience in both electrical and mechanical engineering practice.

Applicants must be natural born British subjects between ages of 25 and 45. Forms from Ministry of Labour, Technical and Scientific Register (K), 26 King St, London S.W.1, quoting D.158/OA. (P 321)

SOUTH WEST METROPOLITAN REGIONAL HOSPITAL BOARD

PRINCIPAL ASSISTANT ENGINEERS II
(HEATING AND VENTILATING)
AND (ELECTRICAL)

APPLICATIONS are invited for the above appointments on the permanent staff of the Board's Regional Engineer generally in accordance with Whitley Council conditions of service.

The Board is undertaking a considerable programme of hospital development and the persons appointed will be engaged on varied and interesting work in connection with major projects in this programme.

The commencing salary will be at the minimum of the scale £1,195 x £45(2) x £15(1) x £45(2) x £30(1)—£1,420, plus London Weighting allowance of £50 p.a. (Scale under review.) Applicants must be Corporate Members of the Institution of Mechanical or Electrical Engineers and should be experienced in the preparation of specifications, drawings and estimates for large engineering installations in hospitals and large public buildings.

Applications stating age, qualifications, experience, present appointment and salary, together with the names and addresses of three referees, should be sent to the undersigned at 40 Eastbourne Terr, London W.2, by not later than 16 April.

E. G. BRAITHWAITE,
Secretary.
(P 575)

THE SOUTH WALES ELECTRICITY BOARD

ASSISTANT ENGINEER

EAST MON DISTRICT (CWMBRAN)

MONMOUTHSHIRE AND MID WALES AREA

SALARY: N.J.B. F.11, £710/£755 per annum. At the present rate of progress there are prospects that the classification of this District will be Class G in the not too distant future.

The District comprises approximately 270 square miles of urban and rural areas with large industrial and domestic supplies, and the post would be particularly suitable for a young Engineer with a Higher National Certificate in Electrical Engineering and some practical experience of distribution work.

The successful applicant may be able to obtain housing accommodation in the Cwmbran New Town (Nr. Pontypool) after a reasonable waiting period.

Applications stating age, present position, present salary, qualifications and experience, should be addressed to D. G. Gwyn, B.SC., A.M.I.E.E., Manager, Monmouthshire and Mid Wales Area, Albany Chmbrs, Skinner St, Newport, Mon, so as to arrive not later than Saturday, 23 April, 1960. Envelopes should be endorsed "Assistant Engineer 46/60."

ASSISTANT ENGINEER

(a) Assistant Engineer, Pontardawe/Ammanford District. Salary: N.J.B. E.11, £655/£700 per annum.

ENGINEERING DRAUGHTSMAN

(b) Engineering Draughtsman, Port Talbot District. Salary, N.J.B. D.6, £620/£740 per annum.

Applications, stating age, present position, present salary, qualifications and experience, should be addressed to G. R. T. Edwards, B.SC., M.I.E.E., M.AM.I.E.E., Manager, 29 Ystrad Rd, Swansea Industrial Estate, Swansea, so as to arrive not later than Saturday, 23 April, 1960. Envelopes should be endorsed (a) "Assistant Engineer 73/60" or (b) "Engineering Draughtsman 72/60."

R. G. WILLIAMS,
Secretary.
(P 580)

THE EAST MIDLANDS ELECTRICITY BOARD
Coventry Sub-Area

APPLICATIONS are invited from suitably qualified and experienced persons for the following appointments:

Vacancy No. 33/60.
SENIOR ASSISTANT
(CREDITORS' ACCOUNTS)

Salary: N.J.C. Grade 4, £795 x £25—£870 per annum.

The successful applicant will be responsible to the Principal Assistant (Expenditure—Prime Costs) for the Creditors' Accounts Section including liaison with the Punched Card Machine Section—co-ordination of activity relative to vetting of invoices, Goods Received Notes, preparation of Payment Schedules, Wayleave Payments, etc.

Vacancy No. 34/60.
SENIOR ASSISTANT (STORES ACCOUNTS)

The successful applicant will be responsible to the Principal Assistant (Expenditure—Prime Costs) for all preparatory work in connection with prime documents in co-operation with the Machine Unit, manual records for certain sections of Stores, Control Accounts, examination of Stores tabulations, material transfers between Stores, lists of slow-moving stocks, progressing of stores adjustment documents, and the preparation of information for the General Accountancy Group.

Applications stating age, qualifications, present position and salary, previous experience and quoting the appropriate Vacancy Number, should be forwarded to the Manager, Coventry Sub-Area, Sandy La, Coventry, within 14 days of the date of this advertisement. (P 597)

CITY OF SALISBURY
Southern Rhodesia

ELECTRICITY DEPARTMENT
VACANCIES FOR TECHNICAL ASSISTANTS
GRADE 2

APPLICATIONS are invited for the fixed establishment posts of Technical Assistants, Grade 2, in the Salisbury Municipality Electricity Department, on the scale £1,100 x £50—£1,250 p.a., plus 2½%. Commencing salary is at the minimum of the grade and no allowances are payable.

Candidates must be thoroughly experienced in all types of meter testing, particularly high tension, transformer operated, polyphase equipments, both kW and kVA, and should be capable of carrying out all duties in connection with a standardising laboratory.

The main duties of the posts are:

1. Testing and calibrating high tension and special types of metering;

2. Standardising instruments and substandard meters against potentiometer equipment;

3. Radio and phase angle testing of instrument transformers;

4. Testing all types of instruments and metres, and general supervision of metering work.

The appointments will be subject to the City Council's Service and Leave Regulations. A successful candidate will be required to furnish to the Council a satisfactory medical certificate of fitness and to serve a probationary period of not less than six months, and if thereafter confirmed in his appointment, to join the Southern Rhodesia Local Authorities' Joint Pension and Widows' and Orphans' Fund. He must also be able to comply with the requirements of the Federal Immigration Authorities.

Candidates must submit full particulars of their qualifications, training and experience, giving details of positions held and salaries received. Age, place of birth, nationality and marital state should be stated and copies of not more than three recent testimonials may be forwarded.

Particulars of the undertaking and a summary of conditions of service, pension and leave entitlements, etc., may be obtained from Messrs Davis and Soper Ltd., 52-54 St. Mary Axe, London E.C.3, to whom applications must be submitted on or before 30 April, 1960. (P 559)

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:

Wolverhampton and District Sub-Area

DEPUTY SUB-AREA ENGINEER
(HEADQUARTERS)

Experience necessary in the administration of a large engineering department and in the planning, construction, operation and maintenance of an extensive distribution system. Applicants should possess appropriate qualifications. Salary: £1,725/£1,830 per annum (N.J.B. Grade K.2).

GENERAL ASSISTANT DISTRICT ENGINEERS (TWO) (WALSALL)

Applicants should have had a sound technical training and experience in all branches of distribution work. Technical qualifications desirable. Salary in accordance with N.J.B. Schedule A, Grade G13 (£655/£700 per annum), Grade G12 (£710/£755 per annum) or Grade G11 (£765/£810 per annum), according to qualifications and experience.

Apply, by letter, within 14 days, stating age, qualifications, experience, present position and salary to Mr D. Holt, Sub-Area Manager, Midlands Electricity Board, 83 Darlington St, Wolverhampton.

F. W. CATER,
Secretary.
(P 578)

YORKSHIRE ELECTRICITY BOARD

No. 4 (Leeds) Sub-Area

SENIOR ASSISTANT ENGINEER
(CONSTRUCTION)

PREFERENCE will be given to Corporate Members of the Institution of Electrical Engineers, or applicants with equivalent qualifications. Wide experience in programming and supervising construction work for substations, buildings and underground and overhead networks in industrial, urban and rural areas is required, together with ability to take administrative control under the Sub-Area Engineer of the Construction Section.

Salary: N.J.B. Class L, Grade 4, £1,600 x £35—£1,705 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 4 (Leeds) Sub-Area, Yorkshire Electricity Board, Bramhope, Nr. Leeds, not later than 22 April, 1960.

No. 5 (Wakefield) Sub-Area

CASTLEFORD DISTRICT
DISTRICT SENIOR CLERK

The successful applicant will be responsible for all clerical work in the district including stores, collection of accounts, meter reading and commercial records.

Possession of a recognised qualification will be an advantage.

Salary: N.J.C. Grade 7, £1,070 x £30—£1,160 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a Denby Dale Rd, Wakefield, not later than 22 April, 1960.

No. 1 (Bradford) Sub-Area

PRINCIPAL ASSISTANT
(ACCOUNTANCY, COSTING AND STORES)

Applicants should have a wide experience of accountancy costing and stores recording, particularly by punch card methods, and experience in staff control.

Possession of a recognised qualification is desirable.

Salary: N.J.C. 7, £1,070 x £30—£1,160 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 1 (Bradford) Sub-Area, Yorkshire Electricity Board, 45-53 Sunbridge Rd, Bradford, not later than 22 April, 1960. (P 594)

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Division

NORTHFLEET TRANSMISSION DISTRICT
VACANCY 81/60.
FOURTH ASSISTANT ENGINEER

REQUIRED for Operation and Maintenance work on 275 kV and 132 kV overhead lines, cables, transformers, switchgear, etc. Experience on similar equipment and possession of O.N.C. would be an advantage.

Salary: Class AX/DX, Grade 7, £890/£1,090, or Grade 8, £775/£985 including London Allowance, according to experience and qualifications. N.J.C. Conditions of Service.

Applications giving age, details of experience, present position, etc., should be sent to the Personnel Officer, Central Electricity Hse, Lower Ham Rd, Kingston upon Thames, Surrey, to arrive by 22 April, 1960.

W. H. DUNKLEY,
Divisional Controller.
(P 577)

SOUTH EASTERN ELECTRICITY BOARD

SENIOR SALES REPRESENTATIVE
WOKING DISTRICT

SALARY: £640 x £20—£700 p.a. under N.J.C. Grade 2. Superannuable. The person appointed will be required to give advice on supply matters, tariffs and appliance sales and installations, for domestic and small commercial consumers. Applicants must be thoroughly conversant with all types of domestic electrical equipment. Possession of an E.D.A. sales certificate or equivalent would be an advantage.

Applications, quoting ET and naming two referees, on forms from District Manager, Seeboard, 4 Chobham Rd, Woking, by 20 April, 1960.

G. WRAY,
Secretary.
(P 602)

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

APPLICATIONS are invited for the following positions within the Division:

PLANT SHIFT CONTROL ENGINEER
DRAKELOW "A" POWER STATION
Vacancy No. 72/60.

Experience desirable in control of boilers and turbines at high pressure and temperature, pulverised fuel, together with electrical control room experience. Technical qualifications to Higher National Standard desirable.

Salary will be in accordance with Class J, Grade 10 (£910/£955 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications: 15 April, 1960.

CLERK OF WORKS
TRANSMISSION CONSTRUCTION DEPARTMENT
Vacancy No. 80/60.

Applicants will be required to supervise the construction of overhead lines and should have extensive experience in all phases of the construction of steel tower overhead lines using SCA conductor.

Salary will be in accordance with Grade 4 (£795/£870 per annum) of the National Joint Council Agreement.

Closing date for receipt of applications: 15 April, 1960.

These appointments will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from the Divisional Establishments Officer, Central Electricity Generating Board, East Midlands Division, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated.

O. S. WOODS,
Divisional Controller.
(P 595)

SOUTH OF SCOTLAND ELECTRICITY BOARD

Dumfries and Galloway Area

THIRD ASSISTANT ENGINEER
(PROTECTION)

APPLICATIONS are invited for the superannuable post of Third Assistant Engineer (Protection) at Area Headquarters, Applicants should have experience in the commissioning and routine testing of protective substation and mains equipment on systems up to 33 kV.

Salary: N.J.B. Class G, Grade 10, £815/£860 per annum.

Applications, on the standard form, should be sent to the Area Manager, S.S.E.B., Marchmount, Dumfries, not later than 19 April, 1960. (P 589)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

SECTION ENGINEER required at Oswestry. Salary within the range £910/£955 per annum (N.J.B. F.7).

Applicants should preferably have had experience in the construction, operation and maintenance of overhead and underground high and medium voltage networks, with their associated substations and equipment.

Appointment subject to medical examination. Pension Scheme.

Application forms obtainable from the Manager, No. 4 Sub-Area, Rhostyllen, Wrexham. Closing date: 13 April, 1960. (P 574)

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

SHIFT CHARGE ENGINEER

REQUIRED at Hams Hall "A" Power Station, near Birmingham. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade K7, £1,195/£1,270 per annum, plus 10% Shift Allowance.

A sound technical training and practical experience in the operation and maintenance of steam generating plant and main switchgear in a large modern power station are required, also a knowledge of P.F. firing. Appropriate qualifications an advantage.

Apply, quoting vacancy number 64/60MD, on form AE6, available from J. Paxton, Esq., Station Superintendent, Hams Hall Power Stations, Lea Marston, Sutton Coldfield, Warwickshire. (P 598)

COUNTY BOROUGH OF DERBY

BOROUGH ENGINEER AND SURVEYOR'S DEPARTMENT
APPOINTMENT OF STREET LIGHTING SUPERINTENDENT

APPLICATIONS are invited for the appointment of a Street Lighting Superintendent at a salary in accordance with Grade III of the National Charter (£880/£1,065 per annum).

Street lighting in Derby is by electricity only. Preference will be given to those candidates who are Associate Members of the Institution of Electrical Engineers and Members of the Public Lighting Engineers' Association.

National conditions of service with car allowance, permanent staff appointment, subject to medical report, and superannuation, and to one month's notice on either side.

Applications should be forwarded to Mr M. L. Francis, Borough Engineer and Surveyor, The Council Hse, Corporation St, Derby, endorsed "Street Lighting Superintendent," not later than 22 April, 1960.

The Council is not in a position to provide or assist in the provision of housing accommodation for the successful candidate.

Canvassing, directly or indirectly, will be a disqualification, and candidates should state whether they are related to any member or senior official of the Council.

G. H. EMLYN JONES,
Town Clerk.
(P 590)

CENTRAL ELECTRICITY GENERATING BOARD
Midlands Division

ASSISTANT MAINTENANCE ENGINEER (MECHANICAL) is required at Walsall Power Station. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade J8, £1,025/£1,085 per annum.

A sound technical training and practical experience in modern power station mechanical maintenance is required and the possession of appropriate technical qualifications will be an advantage.

Apply, quoting Vacancy No. 61/60MD, on form AE6, available from the Establishments Officer, 53 Wake Green Rd, Moseley, Birmingham 13, by 20 April, 1960. (P 570)

BRITISH ENGINE BOILER AND ELECTRICAL INSURANCE CO. LTD., Longridge Hse, Manchester 4. ELECTRICAL SURVEYORS required in England and Scotland. Permanent positions carrying progressive salary scale £800/£1,100 and non-contributory pension. Candidates aged 26 to 32, with H.N.C. in Electrical Engineering or Grad. I.E.E. and with apprenticeship in manufacture or repair of electrical machinery, are invited to apply stating age, qualifications and experience. (P 591)

FALKS have vacancies for REPRESENTATIVES in the London area. Knowledge of Contracting Trade essential. Apply Sales Department, 91 Farringdon Rd, E.C.1, stating salary required and full details of previous sales experience. (P 584)

GENERAL ELECTRIC CO. LTD.

Heating Division

This division of the Lighting and Heating Group requires additional administration and sales staff to meet the demands of large scale expansion. Young men aged 22-28 with previous electrical experience, particularly in the following fields, are invited to apply: Heavy Duty Equipment, Infra-Red Heating Equipment, Heating Elements, Electric Incinerators. Applications should be made in writing, quoting Ref. I.H., to the Staff Manager, Magnet Hse, Kingsway, W.C.2.

(P 572)

ELECTRICAL REPAIR Business in North-West Kent have vacancy for MANAGER, experienced in rewinding and overhaul of Industrial A.C. and D.C. motors and electrical equipment of all types. Write stating age, education, apprenticeship, subsequent experience and present salary to Box No. 7813, Electrical Times. (P 586)

GKN

ELECTRICAL ENGINEERS

THE GROUP RESEARCH LABORATORY requires Electrical Engineers to design and develop equipment for the control of automatic processes. This work will involve circuit design, instrumentation and the production of prototype equipment.

Posts are available at the Laboratory at Wolverhampton for:

1. A graduate engineer who is a qualified electrical or electronic engineer. He should have experience in modern electronic techniques, including the use of semi-conductors. Applicants should be between 25-30 years. (Ref. EE/1.)

2. An electrical engineer, qualified to H.N.C. or an equivalent standard, with considerable industrial experience. (Ref. EE/2.)

Applications, quoting the reference and giving details of career to date, age, salary, qualifications, etc., should be made to:

The Recruitment Officer,
G.K.N. Group Research Laboratory,
Birmingham New Rd,
Lanesfield,
Wolverhampton.

(P 571)

CHIEF CONTRACTS ENGINEER required to act as technical assistant to Contracts Manager. Applicants to be fully experienced in handling major switchgear contracts and have administrative experience in Contracts and Drawing Office. Applications stating age, experience and qualifications to General Manager, South Wales Switchgear Ltd., Blackwood, Monmouthshire, marked "Private and Confidential." (P 562)

ESTIMATOR wanted by Electrical contractors.—Write stating experience and salary required to Box No. 7817, Electrical Times. (P 609)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY

A.E.R.E. Harwell Vacancies for Instrument Mechanics

with good electro/mechanical or electronic instrument experience. Interesting and high-quality type of work in congenial surroundings. Vacancies also exist at the new establishment nearby at Culham and the National Institute for Research in Nuclear Science and applicants will be considered for all three establishments should they so wish.

Married men will be eligible for housing if living outside the Harwell transport area.

Please write for further information and application forms to

INDUSTRIAL RECRUITMENT OFFICER,
A.E.R.E. Harwell,
Didcot, Berks.

(P 585)

An opening has arisen in the Home Sales Department of

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The successful applicant will be a well-educated man having a sales background with experience of dealing with customers' correspondence. He will not be expected to be a technician, but some knowledge of Electrical Engineering will be of assistance to him.

After a qualifying period of service, he will be entitled to membership of a generous Staff Life Assurance and Pension Scheme.

Applications should be made in writing to the Personnel Manager, giving the fullest details of schooling, educational attainments and work history. (P 605)

CENTRAL ELECTRICITY GENERATING BOARD

SOUTHERN, SOUTH WESTERN AND SOUTH WALES REGION

Second Assistant Engineers (Standards)

Regional Standards Department

Applications for two posts at Regional Headquarters, Bristol, are invited from Engineers who will be required to assist in the standardisation of general engineering stores used in power station and main transmission system maintenance.

This will involve the initiation of proposals for standard ranges and types of stores designed to reduce unnecessary variety and the preparation of appropriate specifications.

Development of Engineering Standards within the C.E.G.B. is interesting and expanding work and will eventually be extended to plant spares.

Whilst a knowledge of Standardisation work is not essential, it is desirable that applicants should have a good knowledge of power station or transmission plant and have had workshop and drawing office experience. Applicants should also be of H.N.C. level.

The posts will be placed within Schedule B, Class AX/EX, of the National Joint Board Agreement for the Electricity Supply Industry, and graded in one of the following two salary scales according to the qualifications and experience of the successful applicants:

Grade 3 £1,365 x £25 - £1,490 - £1,630

or

Grade 4 £1,180 x £25 - £1,305 - £1,445

Applications on form AE6/ACT, obtainable from the

Regional Secretary,
Central Electricity Generating Board,
Southern, South Western and South Wales Region, 1 Eaton Crescent, Bristol 8

accompanied by any additional information thought necessary, should be returned to him by not later than first post on Friday, 22 April, 1960.

Regional Vacancy Notice No. 51 should be quoted on the application.

(P 563)

W. H. ALLEN SONS & CO. LTD.

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(Ref. No. 502/7)

and

AN ELECTRICAL CONTRACTS ENGINEER

(Ref. No. 503/7)

Both should be between 25 and 35 years of age.

The Designer should have experience of A.C. Motors and Alternators up to 500 h.p. and 400 kW. Some knowledge of D.C. machines would be an advantage.

The Estimator should be capable of handling all classes of tenders for A.C. and D.C. machines and control gear.

It is preferred that both should hold technical qualifications, and appropriate membership with the I.E.E. is encouraged.

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The Personnel Manager,
W. H. ALLEN SONS & CO. LTD.,
Queens Engineering Works,
BEDFORD

(P 516)

DRAUGHTSMAN required for Consulting Engineers' Office, to assist in the design of lighting and power installations for all classes of buildings. Five-day week. Spring and summer holidays. Pension scheme and luncheon vouchers. Apply in writing, stating age, experience, present salary and salary required to: J. Roger Preston and Partners, 15 North Audley St, W.1. (P 582)

ELECTRICAL ENGINEER required in London area for the design of electrical installations in all types of buildings. Must be capable of running a project through all its phases including site supervision. Write giving full details of qualifications, experience and salary required to Box ET260, L.P.E., Romano Hse, 399/401 Strand, London W.C.2. (P 581)

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Write to the Chief Engineer at the above address for interview, or telephone FELtham 2271.

(P 507)

WANTED 677 Trainee Engineers

The Electricity Supply Industry has vacancies this year for 677 recruits to its engineering training schemes. They are required both by the Central Electricity Generating Board and by the 12 Area Electricity Boards.

83 university graduates are needed as graduate trainees. They should possess a degree in electrical or mechanical engineering of a British university.

73 technical college graduates are required as engineering trainees. They should possess a Diploma in Technology, a College Diploma, a Higher National Diploma or a Higher National Certificate in electrical or mechanical engineering.

521 school-leavers are needed as student apprentices. There are two levels of entry: for those who possess a good Ordinary level G.C.E., including passes in maths and science, and for those who have taken G.C.E. at "O" level and have also obtained passes in maths and physics at Advanced level.

Training for university and technical college graduates is by means of a planned two-year course of practical experience, satisfying the requirements of the professional institutions.

Training for school-leavers is by means of a five-year apprenticeship, including day-release or a Sandwich Course, leading to a professional engineering qualification.

On satisfactory completion of training, all trainees are guaranteed employment in this essential, expanding industry. A wide range of careers is available in many types of engineering – generation, transmission, distribution, commercial and research. Because the demand for electricity doubles every ten years, the prospects of promotion are good.

For further information write to:

The Education and Training Officer,
The Electricity Council,
13 Winsley Street,
London, W.1

(P 564)

ELECTRICAL ENGINEER required for Consulting Engineers' Office, to carry out the design of lighting and power installations for all classes of buildings. Five-day week. Spring and summer holidays. Pension scheme and luncheon vouchers. Apply in writing, stating age, experience, present salary and salary required, to J. Roger Preston and Partners, 15 North Audley St, W.1. (P 583)

NUCLEAR POWER PLANT OPERATION

SHIFT MANAGERS are required by The United Kingdom Atomic Energy Authority, Production Group, at Windscale and Calder Works, Sellafield, Seascale, Cumberland.

Applications are invited from ENGINEERS and PHYSICISTS to fill vacancies on the Advanced Gas Cooled Reactor project and at the Calder Hall Nuclear Power Station, to be responsible, on shift, for the safe and efficient operation of their station, including nuclear reactors, steam and electrical generating plant and associated experimental facilities.

Engineers must have served a recognised engineering apprenticeship and be Corporate Members of a Senior Engineering Institution or equivalent. Physicists should possess a good Honours Degree. Candidates should have had experience of plant operation, i.e., shift operation in a power station or work on a process plant or large scale research facility. A course of training at a Reactor School and at an operating Nuclear Power Station will be provided.

Salary within the scale £1,370/£1,825 p.a., according to qualifications and experience, with additional payments for regular shift work.

Contributory Superannuation. Staff Housing Scheme.

Send postcard for application form, quoting reference P/W.23/J.8, to Recruitment Officer, U.K.A.E.A., Production Group, Windscale and Calder Works, Sellafield, Seascale, Cumberland.

Closing date: 25 April, 1960. (P 561)

ELECTRICAL ENGINEER required for Glasgow Office staff, age 23-28. Applicants (H.N.C. minimum) should have had experience in the manufacture of electrical machines. Progressive salary with non-contributory pension. Applications stating age, nationality, qualifications and experience to British Engine Boiler and Electrical Insurance Co. Ltd., 98 West George St, Glasgow C.2. (P 592)

APPOINTMENTS WANTED

MOTOR CONTROL GEAR, etc. Component and control centre design and detail drawing. 15s hr.—Box No. 7815, Electrical Times. (P 593)

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ENTHUSIASTIC YOUNG AGENT requires additional agency for manufacturers of electrical products to the electrical wholesaler in London and Provinces. Established connections of over 40 clients in this area.—Box No. 7811, Electrical Times. (P 565)

PATENTS

THE proprietor of British Patents Nos. 704893 and 704894, entitled "Automatic reclosing electric circuit breakers" and "Improvements in automatic reclosing electric circuit interrupters," offers same for license or otherwise to ensure practical working in Great Britain. Inquiries to Singer, Stern and Carlberg, 14 E. Jackson Blvd., Chicago 4, Illinois, U.S.A. (P 566)

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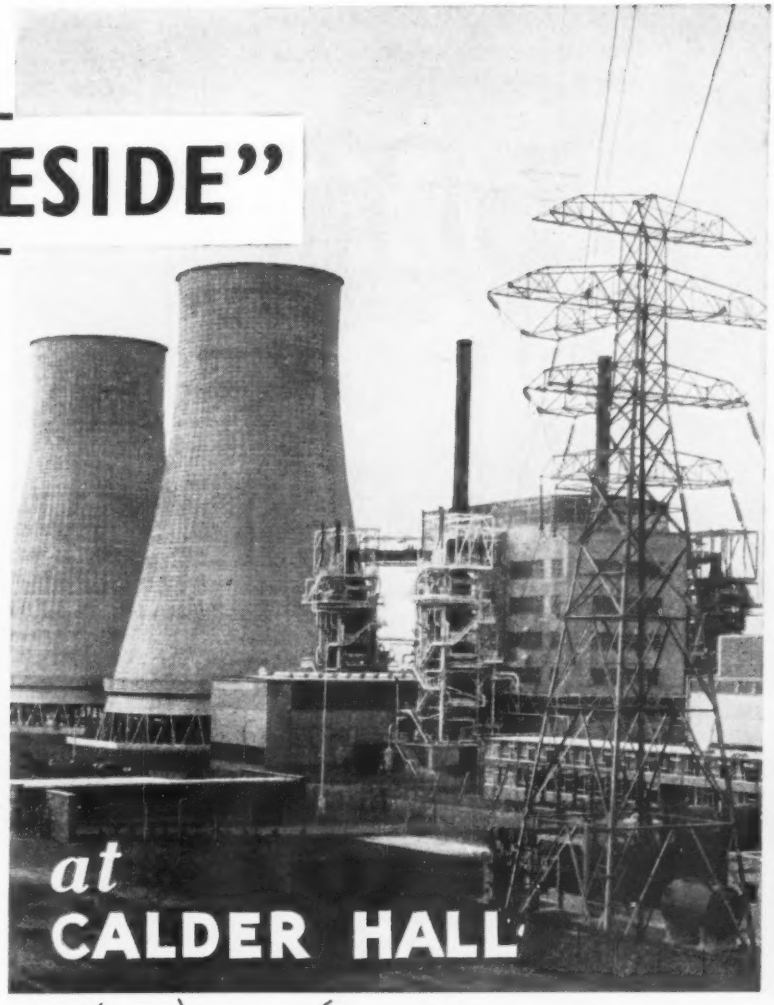

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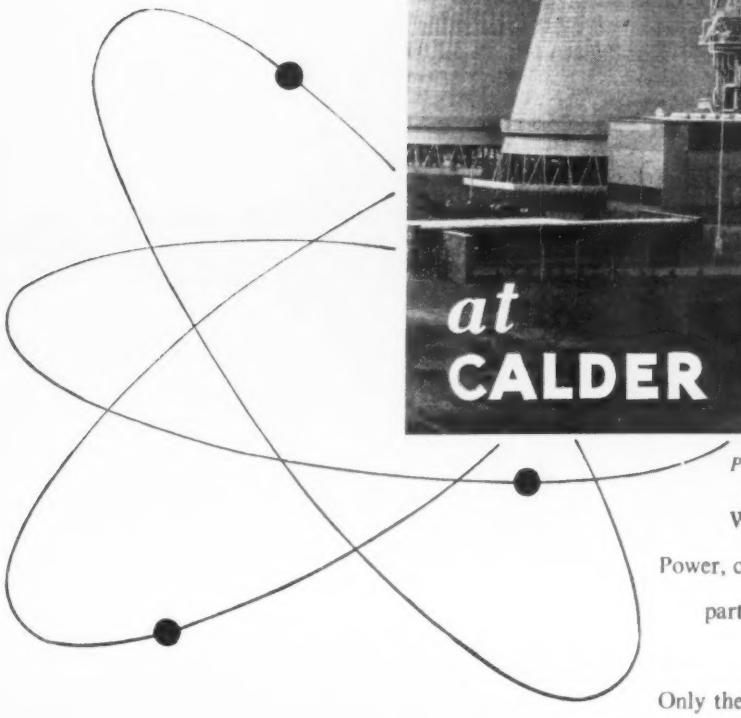

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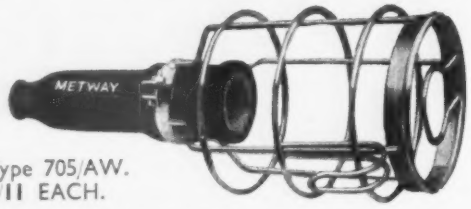

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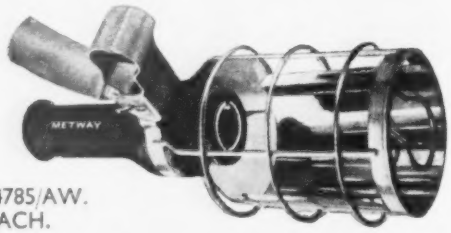

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Sheathed in *seamless* extruded aluminium, this cable is lightweight yet strong. It needs no armouring, thus allowing simple cable design. With a high resistance to vibration fatigue, it can be used with complete safety, alongside railways etc.

It's flexible

Corrugation results in greater flexibility, permitting the same bending radius as a lead sheathed cable. Not only are handling qualities improved but corrugation reduces the required thickness of the sheath *by one half*.

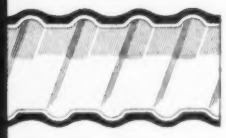
It's a money saver

Initial costs are therefore lower than conventional type cables of similar performance. Lightness and flexibility simplify transportation and installation. No special precautions are necessary to allow for expansion and contraction.

Further information is available on request.

It's the BICC C.S.A. cable

CORRUGATED
SEAMLESS
ALUMINIUM



PROTECTIVE SERVING

Anti-corrosion protection is provided by an extruded P.V.C. covering which fits tightly over the whole sheath surface. *See section view.*

INSTALLATION

Conventional installation procedure is followed. Jointing techniques are the same as for normal smooth aluminium-sheathed cables.

CABLE TYPES

C.S.A. sheathing is available with BICC Mass - Impregnated Non - Draining (M.I.N.D.) Cables up to 33kV and for Oil-Filled Cables.

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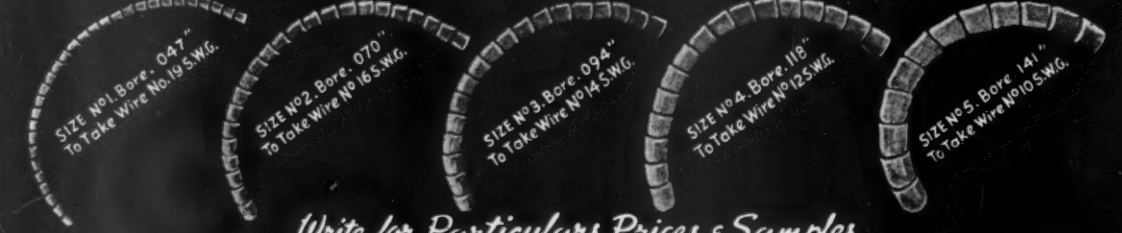
SIZE No1. Bore. 047" To Take Wire No.19 S.W.G.
SIZE No2. Bore. 070" To Take Wire No 16 S.W.G.
SIZE No3. Bore. 094" To Take Wire No 14 S.W.G.
SIZE No 4. Bore. 118" To Take Wire No 12 S.W.G.
SIZE No 5. Bore 141" To Take Wire No 10 S.W.G.

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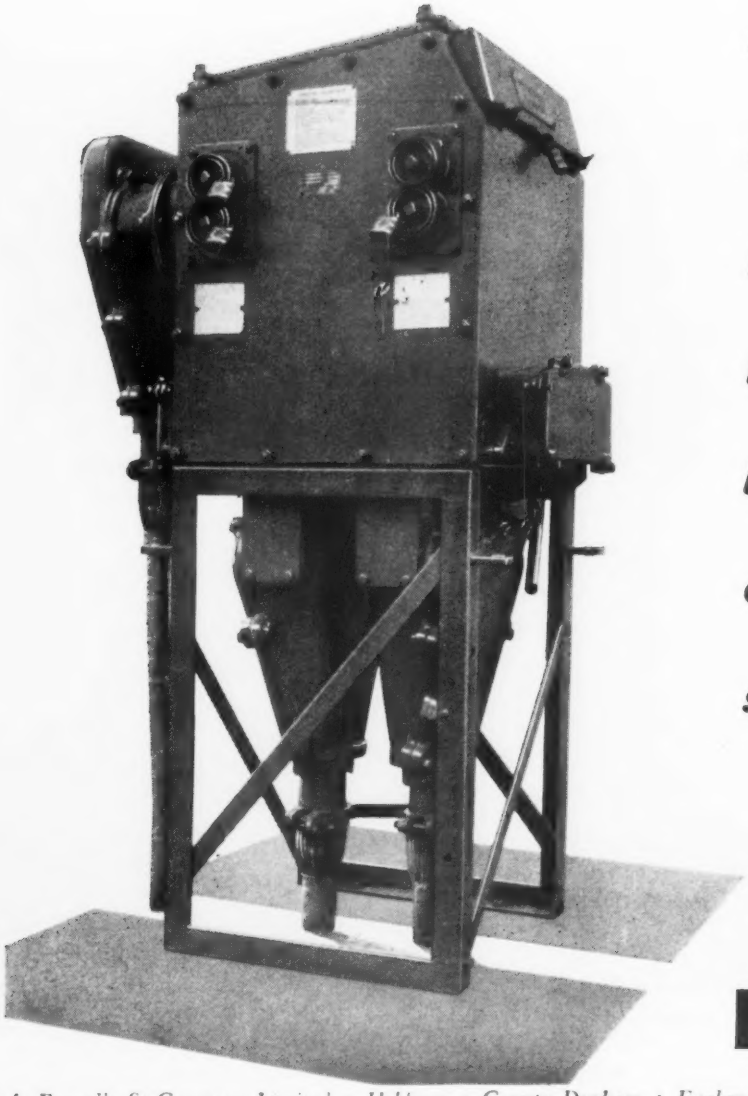
Class-J switchgear consists of type-JS single-switch, type-JSS double-switch, and type-JK fuse-switch units together with type-JKSS ring-main units which combine two switches and one fuse-switch

Up to 11 kV



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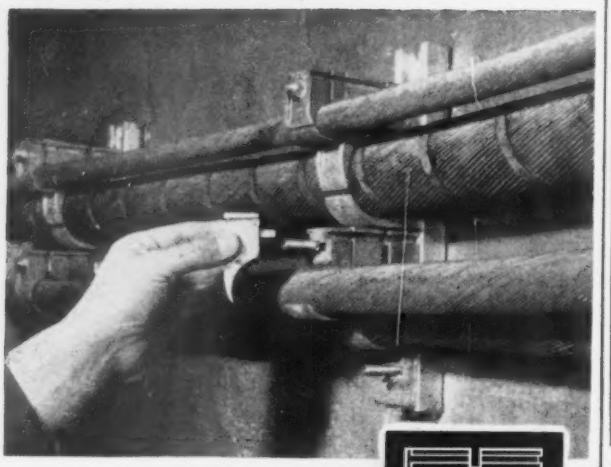
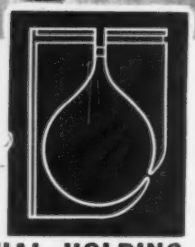
Contractors are cutting costs with CS Cable Supports



The CS hook section supports the cable during installation, leaving the hands free for fixing. Note the extremely neat appearance of the CS installation.



UNIQUE HOOK SECTION ELIMINATES MANUAL HOLDING

Many important new buildings are installing cables with the new CS cable support system, a notable example being St. Christopher House, Southwark Street, London. As is clearly shown in the illustration the unique hook section eliminates manual holding of the cable during fixing. A universal channel section simplifies adaptation vertically and horizontally. All components are in aluminium alloy to British Standard 1490 and 1476 specially selected to give maximum resistance to corrosion. Sizes cater for cables ½" to 3" diameter. Careful design has combined good appearance with economy. The CS system actually costs less than any other system of comparable quality, yet has many unique advantages.

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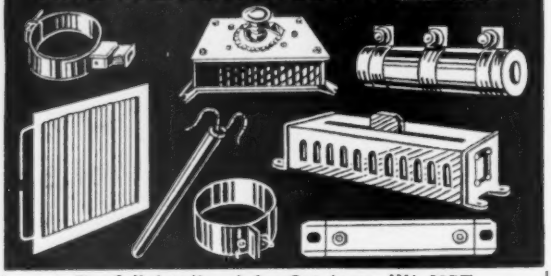

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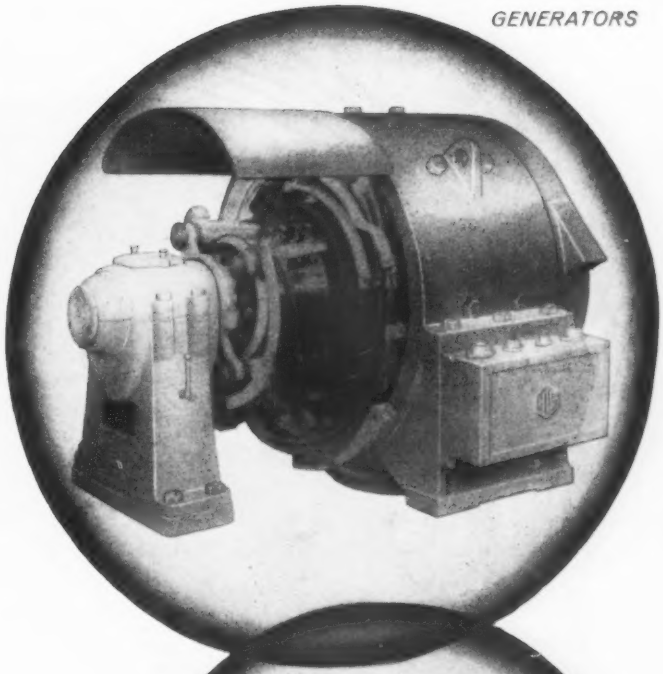

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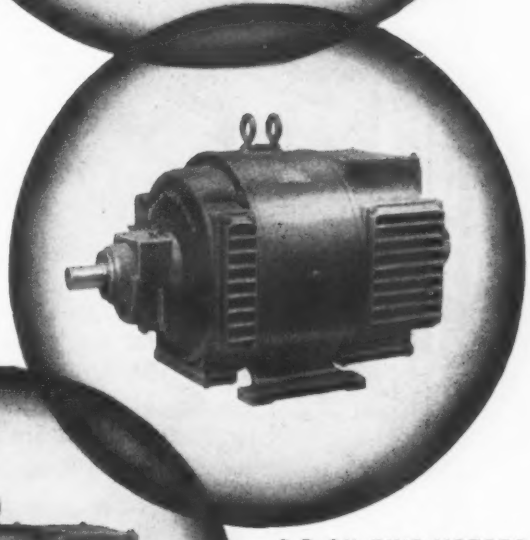

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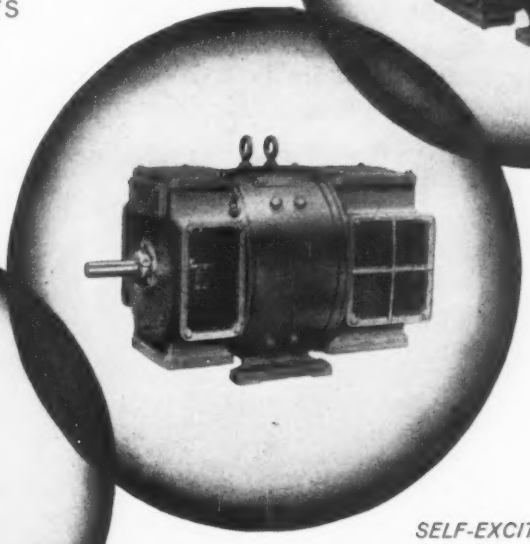

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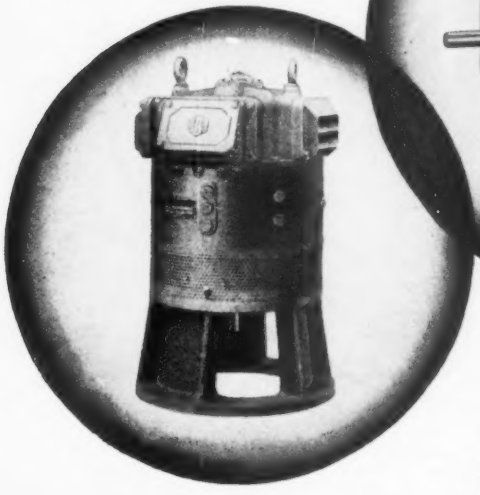

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Flying Repairs. Repairs from overseas are not infrequent at the house of Collins. The above photograph shows two rotors, which had just arrived by air from the Middle East, being unpacked. A few days later they were again in B.O.A.C.'s charge on their urgent way back to another satisfied customer.

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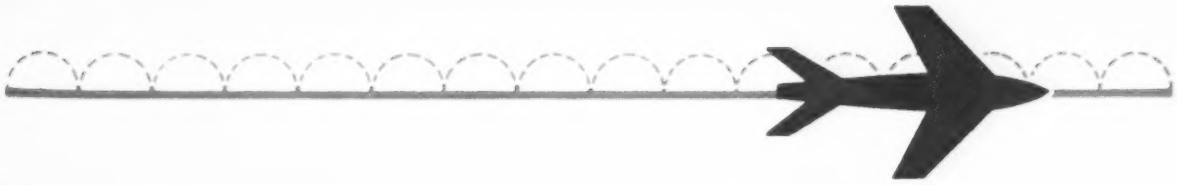
Printed in England by Gibbs & Bamforth Ltd., St. Albans, for the Proprietors, THE ELECTRICAL TIMES LTD., and published at Sardinia House, Sardinia Street, London, W.C.2.



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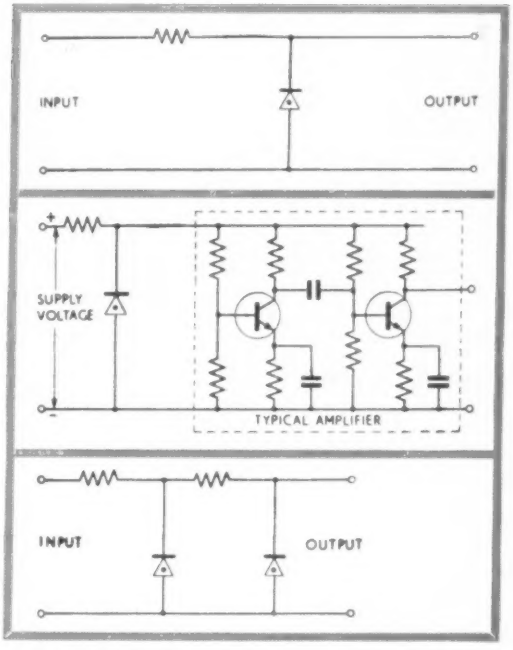

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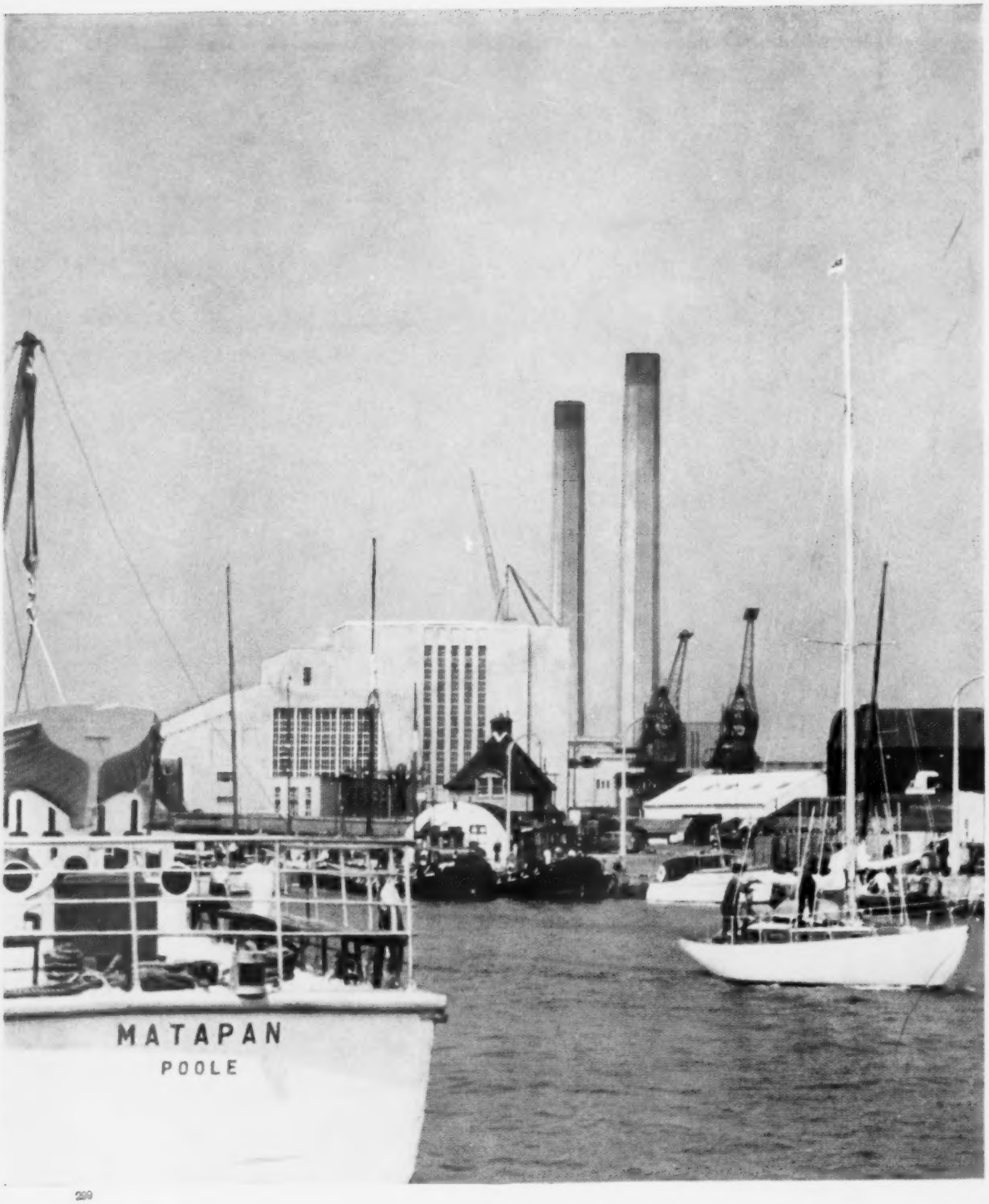

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